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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 2711
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2712
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2712
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2712
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2713
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2714
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2715
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2715
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2716
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2716

Note: N.A. means that no abstracts were assigned to this category for this issue.

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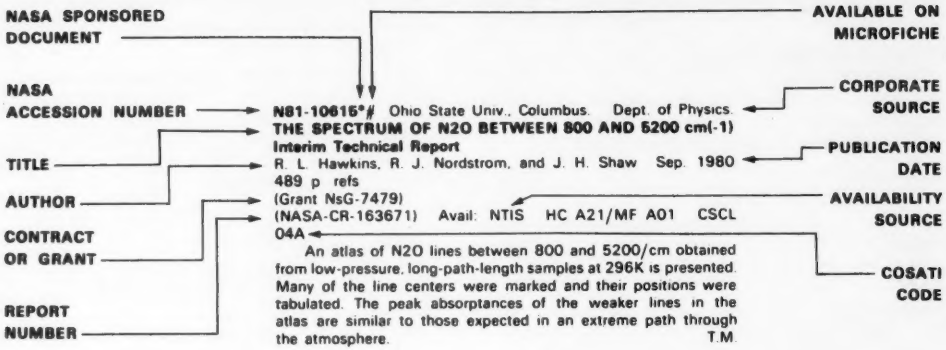
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere.
T.M.
REPORT NUMBER

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, TURBINE ENGINE LOW ASPECT RATIO TECHNOLOGY

P.R. Dodge, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF456730; F33615-74-C-2017)

This program extends the successful technology of AF Contract F33615-68-C-1208 to low aspect ratio turbine blade problems, especially for high temperature cooled blades.

A time phased effort to identify the loss mechanisms of low aspect ratio cooled turbines will be pursued. Cold stationary and rotating rigs will be used to verify loss mechanisms and evaluate methods to reduce these losses. The approach to this improvement is expected to extend the work of F33615-68-1208.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, RPV (REMOTELY PILOTED VEHICLES) AIR-LAUNCHED PROJECTILE CEP AND ANALYSIS

G. Harris, Developmental Sciences Inc., *15747 E. Valley Blvd., P.O. Box 1264, City of Industry, California* 91749 (DA0E3846; DAAK51 78 C 0008)

To demonstrate by conceptural hardward the feasibility and accuracy of RPV air-launched projectiles (2.75-inch rockets).

Design and build an RPV capable of launching 2.75-inch and viper rockets using airborne video data and operator control. After testing, assess techniques and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, AERONAUTICAL TECHNOLOGY, TECH AREA M - AVIATION HUMAN ENGINEERING

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0D5001)

The objectives are to (1) develop principles and methods for integration of the pilot-helicopter interface that will assure full exploitation of both pilot capabilities and advanced technology in improving operational effectiveness and safety with minimal system complexity, and (2) develop techniques for measuring pilot workload and performance with a high degree of precision in the helicopter system RDT&E process.

Systematic exploratory R&D in human performance technology, flight simulation methods and requirements, control and display technology, and man-machine dynamics. The approach emphasizes analytical and experimental studies using laboratory, simulation, mathematical modeling and flight test facilities. These activities have been coordinated with and will complement and support the handling qualities R&D of tech area A and the flight simulator development of tech area K. Objectives will be achieved largely through joint participation with NASA, making maximum use of the facilities and expertise available within NASA for man-machine systems research.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0004, AIRFRAME STRUCTURES

G.H. Lindsey, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN898073)

To develop better methods of fatigue life prediction using data from in-flight fatigue monitors developed on this project.

Using experimental methods of photoelasticity and analytical methods of slip-line theory, stresses and strains in plastic zones at notches will be calculated and residual stresses determined there. Alteration of the stress concentration factor due to yielding will also be quantified for use in cumulative damage analyses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0005, COMBUSTION ANALYSIS PROGRAM

Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF463300; F33615-79-C-2003)

Improve the capability of the combustion analysis program developed under AFML contract.

Using the model prepared under AFML contract a modified computer program will be produced which incorporates the latest findings on combustion kinetics and burn initiation locus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0006, ADVANCED TRANSONIC W/B DESIGN METHODOLOGY

M.E. Lores, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF141350; F33615-78-C-3014)

The Air Force function for this effort is the design development of both transport and fighter aircraft. Transports, which cruise at transonic speeds, and fighters, which maneuver at transonic conditions, have been designed in the past by use of 2-D transonic and 3-D subcritical methods, although most problems are 3-D and transonic in nature. The objective of this effort is to develop more efficient transport and fighter configurations than possible in the past and at a lesser cost. This work will contribute to more fuel efficient transports and more maneuverable fighters at transonic speeds as well as reducing the cost of designing these aircraft.

Recently developed 3-D transonic methods will be incorporated into a design procedure and applied to the development of a transport and a fighter configuration. The configurations will be tested in a wind tunnel and the results of the tests will be used to verify or improve the computer code.

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0007, ANALYSIS OF AH-1S FIRE CONTROL SUBSYSTEM (DA0E3875)

D. Manahan, Cobro Corp., *10750 Columbia Pike, Suite 610, Silver Spring, Maryland* 20901 (DA0G0398; DAAK51-79-C-0034)

The objective of this work is to perform RAM-D and cost measurements on the armament subsystems of the AH-1S helicopter.

The approach is to analyze user experience data that is to be collected under the sample data collection (SDC) effort and apply the AMSEC methodology to provide an interactive model of the armament subsystems. This model will enable RAM-D and cost analysis to be performed under various operational and maintenance scenarios on current and new configurations.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0008, EFFECTS OF FRAGMENTS/PROJECTILES ON MISSION CRITICAL AIRCRAFT COMPONENTS

B.T. Bentley, U.S. Dept. of Defense, Army, Armament Research & Development Command, Vulnerability Lethality Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4485)

To strengthen the methodology and data base for quantification of mission kill and mission available categories of aircraft and helicopter vulnerability.

Identify mission essential components and apply covert methodology.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

1.0009, VATOL FIGHTER STUDY

C. Martin, U.S. Dept. of Defense, Navy, Naval Ship Research & Development Center, Aviation & Surface Effects Dept., *Bethesda, Maryland* 20084 (DN878681)

To quantify the pilot performance required to fly vertical attitude takeoff and land (VATOL) aircraft, and the performance potential of this type aircraft in fighter/attack missions.

3-DOF and 6-DOF simulations will be made of the control system in the critical takeoff and landing modes. Performance predictions of conceptual aircraft will be made. Preparations for 6-DOF, moving base simulation will be made. Investigation of potential research aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

1.0010, SIMULATION ANALYSIS-UNORTHODOX CONTROL FIGHTER AIRCRAFT

A. Mitchell, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF144270; F33615-79-C-3025)

There is a requirement for an analysis of manned air combat simulations which encompass characteristics of multiple engagements (e.g., at least two-on-one or one-on-two) to determine velocity and energy states, longitudinal and normal acceleration states and roll/pitch/yaw rates associated with the highly dynamic environment of close-in air combat engagements. This requirement for analysis and understanding of how the velocity and acceleration states are changed by the pilot as a function of the aerodynamic, propulsion and control characteristics of the aircraft includes both conventional flight control modes and 'unorthodox' control force concepts such as direct lift/side force, drag modulation (e.g., thrust reversal), maneuver enhancement modes via blended aerodynamic and propulsion control, fuselage aiming independent of flight path, and high angle of attack mode beyond normal controlled flight limits by thrust vector control. Analysis of these state changes may require definition of new parameters which relate directly to effectiveness in highly dynamic air combat modes. Analysis of this type of data is also required to determine if the pilots use the aircraft in a near-optimum manner as suggested by the configuration aerodynamic, propulsion and control characteristics, including unorthodox control force modes.

This program shall conduct an analysis of existing data from a manned air combat simulation of conventional and unorthodox control force fighter configurations. The scope of the analysis shall be such that the unorthodox control force (UCF) mode utilization can be determined and related to basic aircraft configuration characteristics. Areas of analysis shall include fighter/weapon effectiveness, fire control systems effectiveness for various missile launch and gun firing envelopes, aircraft state parameter variations, pilot interface with control modes, and preliminary maneuvering effectiveness parameter identification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, MAC STABILITY AND CONTROL DATA DISCREPANCIES

R.W. Thomas, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF143610; F33615-79-C-3608)

This work unit supports TPO3, Flight Control, and major thrust, FGO2D3, Aircraft Stability and Control Prediction. Specifically, it addresses the problem area involving the differences observed between predicted and actual flight characteristics. The objective of this effort is to identify and resolve serious discrepancies observed during an aircraft development program between predicted stability and control values and those measured in-flight. This effort will investigate test and analysis methods used to predict stability and control characteristics which will result in a more accurate mathematical representation of predicted aircraft dynamics.

This program will analyze a discrepancy between predicted and flight test stability and control characteristics observed in the F-15 development program. This analysis will cover both the methods used in obtaining the predicted flight characteristics and the procedures involved in extracting aerodynamic data from flight test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, AIRCRAFT SYSTEMS TEST

O. Wontorsky, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN096121)

Develop guidelines for an organizational level test concept to determine aircraft readiness, minimize support, and use hardware and software to improve self contained test techniques.

Investigations will be conducted to determine relationships between levels of test, test limits and acceptance/rejection criteria methods. A determination will be made regarding the feasibility of using SCT to determine if a weapons system is within operational limits. Test specification methods will be developed to assure full utilization of 0-level test capability at other maintenance levels to minimize hardware/software documentation proliferation and provide more effective total support level.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, ENGINE/MISSION PERFORMANCE ANALYSIS

P.F. Piscopo, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN789769)

Provide engine performance analysis and evaluate engine systems and subsystems with computer simulation in order to make hardware and cycle selection recommendations and provide direction for selected programs.

Computerized engine and aircraft design programs will be developed and continuously updated so that both the uninstalled and installed engine performance can be described and the effect on weapons system performance studied. The NNAP along with inputs from NAVAIR, NADC, and other Navy activities are used to select which weapons systems are to be studied. Engine cycle, weight, and size data are generated by NAPC for high potential propulsion candidates. Under a project order from NAPC covered by a separate report (DN 033112), NADC uses the NAPC uninstalled engine data to create installed engine data and performs simulated missions to determine the best candidate engines. This information is forwarded to NAPC where it is used as one of the criteria for defining new exploratory and advanced development programs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0014, ADVANCED FUEL DELIVERY SYSTEM HARDENED VANE START ELEMENT

A.R. Mulukutla, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN889779; N00140-78-C-0059)

The overall objective is to design, develop and demonstrate a lightweight, compact, contaminant resistant, fuel delivery system for use on advanced augmented gas turbine engines. This contract will continue developments previously reported under DN596806 and DN796803 (WU 673).

The contractor will obtain a fuel contaminant hardened vane pump element to replace the gear-type pump/motor element previously incorporated into the unitized pump developed and tested under contract N00140-75-C-0040. The new unitized pump configuration will be tested separately and in a system set up to confirm satisfactory performance and the capability to operate with contaminated fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0015, HIGH SPEED INSTRUMENTATION FOR GENERATOR TEST FACILITY

W.U. Borger, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458970)

Complete the AFAPL generator test facility by providing a data acquisition and control system with the following capabilities - (1) sufficient acquisition speed to characterize aircraft electrical system transient performance, (2) storage of all performance related test data, (3) short time playback and analysis capability, (4) complete automation, and (5) engine start simulation.

Design system and procure and integrate all necessary components to accomplish objective. System will be composed at a MODCOMP II computer, a high density digital tape drive, 18 10-microsecond conversion A/D converters, and necessary interfacing and control circuitry. The MODCOMP II will be a satellite in the AFAPL computer network.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0016, COMPRESSOR RESEARCH FACILITY INSTRUMENTATION AND DATA ACQUISITION

D. Murray, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463700)

To establish and maintain a state-of-the-art capability for the measurement, collection, and processing of CRF and test article related performance parameters, and to advance the state-of-the-art in related instrumentation and measurement techniques.

To establish and maintain close communication and working relationship with the engine testing community and to anticipate future needs and establish in-house or contracted R&D programs directed toward the solution of unique or advanced instrumentation concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0017, ADVANCEMENT OF ANALYTICAL CAPABILITY FOR DESIGNING ADVANCED AIRBREATHING ENGINES

K.A. Watson, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451180)

The objective of this effort is to generate new, or modify existing, design and analysis tools used to study advanced airbreathing weapon systems. These tools include computer programs, design data handbooks, and data correlation packages used to conduct meaningful preliminary design and trade studies.

Existing computer programs are surveyed to determine their applicability. If these cannot be modified to perform the required task, then a new computer program is written. Existing programs are routinely updated to reflect new or better analysis methods which increase the program's accuracy, reduce execution time, or increase capability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0018, WORKLOAD PROBLEM ASSESSMENT

L.C. Butterbaugh, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142930)

This effort supports the test and evaluation function of the Air Force. Advancements in crew station technology and mission concepts has significantly altered the crew workload associated with performing a mission. Existing technical means of assessing crew workload have not kept pace with the changes in workload. The objective of this effort is to maintain a working level familiarity with workload assessment technology and investigate potential methodologies relative to workload measurement and prediction. Such knowledge will provide the necessary understanding of operational crew workload problems and identify crew system interface areas requiring study. More efficient pursuit of workload assessment methodologies will be realized.

Literature searches of technical libraries and review of aircraft accident reports. Pilot opinion survey of aircrews in the operational commands (TAC, SAC, MAC, etc.). Promising workload assessment methodologies will be previewed for feasibility through limited-effort investigations conducted within the branch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, DIGITAL DATCOM COMPUTER PROGRAM FOR AIRCRAFT STABILITY AND CONTROL

J.E. Jenkins, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132910)

This work unit supports TPO 3, Flight Control, and major thrust, FG02N, Flight Control System Design Techniques. Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The objective of this work unit is to provide improvements in the digital DATCOM computer program, which is an automated stability and control prediction tool. At its current stage of development, it is an efficient computer tool, however, improvements are needed to reduce the engineering time required to prepare input and to interpret output. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design.

Digital DATCOM will be applied to various types of problems, e.g., preliminary design, correcting wind-tunnel data to obtain the effects of configuration changes, etc. The experienced gained will help identify weaknesses in the digital DATCOM program. Particular emphasis will be placed on the evaluation of the input requirements and output suited to specialized tasks, as well as method accuracy and range of applicability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, SYMBOLOGY VERIFICATION

J. Kapala, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141720)

The inability of pilots to distinguish certain display symbols in selected symbology sets has become a matter of growing concern to USAF control display designers. As a part of the digital avionics information system (DAIS) experiment this problem will be addressed by determining through objective analysis, the error rates, search times and flying performance of subject pilots in a cockpit similar to the digital flight control system (DFCS) cockpit. Display symbols which confuse pilot subjects will be modified using an algorithm to determine pilots useability/acceptability of various display options.

A literature search will be conducted on the displays chosen for investigation. Possible alternatives will be programmed and objective performance and subjective attitude of

pilot subjects will be evaluated. This evaluation will allow FGR to select the best display and symbol set. The results of this experiment will be documented in a technical report. Recommendation for an improved symbol set will be submitted to MIL-STD-884C.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, INTEGRATED FLIGHT PATH DISPLAY
C.J. Kopala, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144340)

This work unit will support the design of advanced fighter aircraft cockpits. The flight path display to be designed will combine two current displays, VSD and HSD, onto a single display surface. In addition, it will provide the pilot with perspective and closure cues which have heretofore been unavailable. The objective of the work unit is to develop a three-dimensional pictorial flight path display, and to compare flight performance of A-7 pilots using this display with their flight performance using the current DAIS VSD and HSD CRTS. Their performances will be measured across a number of different flight maneuvers. The new flight path display will increase combat effectiveness by improving pilot navigation through highly dense threat areas.

An extensive review of all studies applicable to this program has been performed and documented in a report. The 3-D display proposed for development will incorporate those features of earlier 3-D models that were found to enhance flight performance. Objective flight performance data will be used to compare pilots use of the 3-D display versus their use of the current DAIS displays. Subjective data will also be taken from the pilots as they use each display set and the data used to compare the display sets.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, DEVELOPMENT OF BOUNDARY LAYER MEASUREMENT TECHNIQUES FOR SIMULATED SUBSONIC & HIGH SPEED FLIGHT OF MILITARY AIRCRAFT & WEAPON SYSTEMS
E. Robinson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF120710)

The performance of advanced high speed military aircraft and weapon systems can be seriously affected by the aerodynamic characteristics and the flow field surrounding these vehicles. This influence can be ascertained by defining the flow field surrounding these vehicles through the simulation and measurement of aerodynamic quantities in ground test facilities. The problem is to develop the techniques to quantitatively analyze boundary layer phenomena and problems occurring in the simulation facilities and to correlate the test results with the actual flight vehicle environment. The results of this work effort will provide devices and equipment to sense, record, and analyze test article and flight system flow data in mass effects and local properties from boundary layer profile surveys.

Development of circuitry and techniques for measuring vital facility and test model parameters. Develop diagnostic techniques for measuring the basic flow properties in these facilities stressing particularly those methods which do not interfere with the flow. Develop and adapt electronic equipment to meet unique facility and test needs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, RESEARCH IN PROPULSION
C.L. Walker, U.S. National Aeronautics & Space Admin., Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DA0E3530)

Conduct basic research to provide a technological base in propulsion systems for aircraft application. This program is fundamental and exploratory in nature and is a continuing effort covering aerodynamics and material requirements for small turbine engines.

Analytical and experimental studies are conducted on Army-funded NASA-administered contracts with private industry and universities. Specific effort is directed toward obtaining aerodynamic and material technologies necessary for designing turbine engines to operate at higher pressure ratios and temperatures.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Propulsion Lab.

1.0024, SURFACE REINFORCEMENT OF GAS TURBINE COMPONENTS BY REFRACTORY COATINGS DEPOSITED BY MEANS OF VACUUM PYROLYSIS
S.R. Brown, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881212)

Utilize vacuum pyrolysis techniques to develop wear, oxidation and sulfidation resistant coatings for advanced aircraft propulsion system components, including hot pressed ceramic and super alloy hot section components.

The advantages of vacuum pyrolytic techniques will be exploited to impregnate and coat thin walled and holed structures with novel refractory materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0025, VALIDATION OF AEROELASTIC TAILORING BY STATIC AEROELASTIC AND FLUTTER TESTS
W.A. Rogers, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF138210; F33615-77-C-3105)

This work supports the functional area of aircraft aeroelastic design involving flight safety and improved aerodynamic performance. Aeroelastic tailoring of composites offers the potential of designing aircraft lifting surfaces to be free from aeroelastic instabilities, provide the required strength margins and improve certain aerodynamic qualities such as improved lift or reduced drag. The work unit will address the validation and quantification of the benefits obtainable through aeroelastic tailoring. The specific objective of this work is to experimentally verify that aeroelastic tailoring of filamentary composite structures for Air Force aircraft will enhance performance and provide a life cycle cost savings. Preliminary analysis results indicate ten percent improvement in turn rate and range can be achieved for a lightweight fighter design and a 15 percent range improvement is possible for a bomber design when aeroelastic tailoring is incorporated. In order to be a usable design concept, an aeroelastically tailored design must also be compatible with cost effective manufacturing concepts, retain the tailored stiffness and strength throughout the service life of the aircraft, and demonstrate the performance gains.

To adequately demonstrate the capability to meet the above stated objectives, scaled models of a representative configuration will be tested to measure aerodynamic performance and deflections under actual airloads and to determine flutter characteristics in a wind tunnel. The tailored stiffness properties of the full scale design will be scaled in the static aeroelastic model for transonic testing. Stiffness and mass will be scaled in the flutter model. The models will be fabricated in composite materials to duplicate the anisotropic properties. Prior to wind tunnel testing, static load deflection and proof tests will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, AERODYNAMICS OF BALLISTICALLY DAMAGED ROTOR BLADES HT 79-15
D. Hollenbaugh, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3862; N/A)

To establish a realistic data base in the area of ballistically damaged rotor airfoil sectional aerodynamic forces in order to develop a better understading of the effect of aerodynamic changes due to ballistic damage on helicopter performance.

Wind tunnel tests will be conducted of both standard metal and experimental composite material 540 profile rotor blade sections. Tests shall be conducted over a range of Mach numbers and angles of attack to simulate spanwise position and flight

condition. Damage shall be simulated using physical parameters from actual damaged specimens created during the SLAMUR and MTS programs.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0027, HT 79-17, EVALUATION OF THE EFFECTS OF VOIDS IN COMPOSITE MAIN ROTOR BLADES

D.G. Orlino, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0G2046)

(a) To determine the propagation characteristics, under repeated loading, of typical manufacturing flaws and defects found on composite main rotor blades. The results obtained from the testing of the K-747 blade will be relevant to composite blades in general and instrumental in defining the need and direction for additional research in this area. (b) Results of testing will, hopefully, serve as an indication as to whether or not void growth problems exist on the K-747 blade.

(a) A total of four K-747 blades shall be tested. Two blades are from the developmental program and two blades will be from the low-rate initial production (LRIP) program. Each blade will be placed in the resonant test fixture and fatigue tested under the design loading spectrum for the AH-1Q helicopter. (b) Each blade will be nondestructively inspected to establish a firm baseline of delamination present in the spar. The blades shall be periodically inspected to determine the growth rate of existing flaws, the creation of new flaws, and any insipient failure. If void growth is absent after 28-million cycles of spectral loading, the load will be increased and testing continued until void growth is present.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0028, PARAMETER IDENTIFICATION FOR AN AEROELASTIC SYSTEM

E. Cliff, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (DF145560)

This work unit supports, in part, the AFFDL/FGC basic research plan that is intended to provide experimental methods to validate theoretical unsteady aerodynamic methods. The identification of the aerodynamic parameters from time history measurements will provide for safer and more precise design of flight control systems. The specific objectives of this work unit is to further develop and apply a maximum likelihood parameter identification procedure to wind tunnel test data from an oscillating wing. Initial application should be to bomber aircraft.

Hereditary aerodynamic models based upon an approximating function and a distributed vortex aerodynamic mathematical model will be assumed as the analytical representation. Measurements of linear and angular position of an oscillating wing will then be identified using the maximum likelihood procedure developed in AFOSR Grant 77-3221 to determine which of the two aerodynamic mathematical models is most appropriate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, REDUCTION OF INTERNAL NOISE IN MILITARY AIRCRAFT USING STRUCTURAL INTEGRATED SOUNDPROOFING

L.F. Butzel, Boeing Co., *7555 E. Marginal Way S., P.O. Box 3999, Seattle, Washington* 98124 (DF143260; F33615-79-C-3206)

The intense exterior noise associated with military aircraft can cause high noise levels within the aircraft. This structurally transmitted noise can degrade flight crew performance, damage electronic equipment and cause structural damage. High interior noise levels can be reduced by incorporating integrated soundproofing into the aircraft fuselage design. Integrated soundproofing is accomplished by tailoring the stiffness, damping and resonances of a structure with the external acoustic field to produce high acoustic transmission losses through the fuselage. The objective of this effort is to investigate techniques of reducing aircraft interior noise levels by using integrated soundproofing to increase fuselage acoustic transmission loss.

The investigation will consist of an analytical study of the acoustic transmission properties of aircraft fuselage structures. This will include the effects of fuselage stiffness, damping and resonances on interior noise with various external acoustic fields. An experimental program will also be conducted. Different structural configurations will be tested for acoustic transmission characteristics. YC-14 data will be used to verify techniques. Criteria for design of fuselage structures with tolerable internal noise levels will result.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, RESONANCE IN WEAKLY NONLINEAR SYSTEMS

J. Kevorkian, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF055900; AFOSR-80-0175)

AF function - aerospace vehicle stability. Opportunity - useful approximate analytic solution of certain nonlinear equations of motion seem attainable. Objective - a parametric understanding of phenomena involving resonance in weakly nonlinear systems. How work contributes -by improving design techniques.

The technique of multiple time (or space) scales, originated by Professor Kevorkian, is one of the most powerful ways to obtain uniform asymptotic expansions of differential and integral equations. It involves introducing slow and fast time variables to obtain a hierarchy of simpler equations for the expansion coefficients. It is proposed to attempt to extend the applicability of this technique to resonance phenomena for weakly nonlinear ordinary and partial differential systems with slowly varying parameters. Conditions for sustained resonance and the change in value of an adiabatic invariant across resonance are examples of topics to be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0031, FDL/MBB FLUTTER SUPPRESSION FLIGHT TEST PROGRAM

O. Sensburg, Messerschmitt Boelkow Blohm GmbH, *Postfach 801169, Munich, Federal Republic of Germany* (DF144840)

Fighter attack aircraft historically are hampered with sometimes severe flight envelope restrictions due to external store flutter. active flutter suppression has been shown through analyses to have sufficient capability to prevent wing/store flutter thereby removing flutter speed placards and improving performance through flight envelope expansion. The objective of this program is to conduct flight tests on an F-4 aircraft, and substantiate the feasibility of active flutter suppression for preventing flutter. The results of this program will ultimately provide USAF fighter aircraft with an air-to-ground mission, an expanded attack envelope, increased survivability and improved operational flexibility.

An active flutter suppression system will be designed and implemented into an F-4 aircraft owned by the Federal Republic of Germany. The aircraft will be flight tested in West Germany under a cooperative AFFDL/Federal Republic of Germany (Ministry of Defense)/Messerschmitt-Bolkow-Blohm program for evaluating the system operational capability. The AFFDL will also conduct analyses for determining the effects of nonlinearities within the aircraft control and actuation systems prior to first flight.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF THE CNTD MECHANISM AND PROPERTIES OF SiC AND ALN DEPOSITION

R.A. Holzl, Chemetal Corp., *Pacoima, California* 91331 (DF054420; F49620-79-C-0041)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - a new CVD-like process known as CNTD (controlled nucleation thermochemical deposition) has been developed for producing very fine-grained materials having superior mechanical properties. Objective - the objective of this research is to study the mechanism and deposition parameters of CNTD for fine grained high strength silicon carbide and aluminum nitride. How work contributes - silicon carbide deposits will be further evaluated by the Air Force for strength, toughness and corrosion resistance for possible impact on the ceramic turbine engine program. Silicon nitride samples will be further characterized for optical, dielectric and thermal properties under concurrent AFOSR research contracts.

The optimum deposition parameters for CNTD will be established to produce fine grain, high strength SiC and AlN. Microstructure and mechanical testing data will be used in an iterative development cycle for optimizing the process. Variables to be studied include gas chemistry, gas preheat, gas flow, partial and total pressure, substrate temperature, methods of heating and geometry of the sample and deposition system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, SURVEILLANCE - METASTABLE RARE-GAS HALOGEN INTERACTIONS

D.C. Lorents, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DN675452; N00014-76-C-0734)

In this work energy transfer from excited atomic systems to diatomic molecules is being studied. Elastic, inelastic, and reactive processes are being monitored. The emphasis is on studying potential curve crossing in atom-molecule collisions. These are important processes in molecular lasers and ceratin ionospheric processes, but have not been well studied in the past due to their complexity. It is important that these processes be better understood since they are important in the naval areas of communication and surveillance.

The competition between various final channels in He metastable and Ar metastable atom collisions with No are being studied. The apparatus is being modified to facilitate the determination of total destruction cross sections.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0003, BASIC STUDY OF FUEL STORAGE STABILITY (17062-E)

F.R. Mayo, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0G3255; DAAG29-80-C-0122)

To investigate fuel instability over a period of three years. This will involve the studies such as (1) free radical oxidation of fuels; (2) detection of deposit precursors; (3) homogeneous and heterogeneous metal catalysis; (4) effect of sulfur, nitrogen and peroxide compounds; (5) stabilization of fuels; (6) predicting and improving stability. Relevance: The storage stability of hydrocarbon fuels continues to be a major part of the US Army Fuels & Lubricants Research Laboratory's mission. The results of this research will be directly applicable to these items - storage of jet, gasoline and diesel fuels.

The approach is based on SRI's unique capabilities and experience in oxidation chemistry as applied to hydrocarbons and coal-derived liquids, and the use of a field ionization mass spectrometer computer system for analysis of complex mixtures. Data obtained by this instrument coupled computer system will be analytically fitted with respect to the research study proposed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, POLYBENZOTHIAZOLES - SYNTHESIS AND CHARACTERIZATION POLYMERS

J.E. Wolff, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF053530; F49620-78-C-0110)

AF function - advanced AF aircraft will require lightweight, high strength, environmentally stable polymeric materials which are easily processible to meet high performance flight requirements. Deficiency -current fiber reinforced composite structures experience problems of fiber-matrix debonding and strength reduction due to environmental effects and fabrication deficiencies. Objective - the objective is to investigate the chemistry and structural requirements of several monomers that form the benzothiazole unit and to study the effects of various synthesis parameters on the formation of high molecular weight, wholly aromatic polymers containing benzothiazole units. How work contributes - the polymers from this research are expected to provide chemically compatible, flexible matrices for molecular composites which are reinforced by molecularly dispersed rodlike benzobisthiazole polymers.

The monomers 4-amino-3-mercaptobenzoic acid and 3-amino-4-mercaptobenzoic acid will be prepared and purified. Optimum polymerization conditions will be determined for the preparation and characterization of poly (2,6-benzothiazole) and poly (2,5-benzothiazole). Three random copolymers of the aforementioned monomers will be prepared, and block copolymers prepared by the mixing of ongoing homopolymerization media at various extents of reaction. Rod-like segments of polybenzothiazole (PBT) will be incorporated by the block copolymerization technique. Molecular composite films will be prepared with 10 percent PBT in the flexible polymer matrices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, MOLECULAR BEAM CARS SPECTROSCOPY

R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (CHE79-12673)

Professor Byer is supported by a grant from the Structural Chemistry and Thermodynamics Program and the Atomic, Molecular, and Plasma Physics Program to carry out detailed high resolution spectroscopic measurements. The major emphasis of Byer's work will be the study of pulsed molecular beams in order to enhance spectral and structural details for important molecular systems such as methane and sulfur hexafluoride. Thus, Byer will be combining state-of-the-art high vacuum technology with high powered laser systems to develop further the utility of coherent anti-Stokes Raman spectroscopy (CARS). The extension of high resolution CARS to sub-Doppler linewidths will provide precise absolute frequency measurements and improve considerably the resolution of complex spectra. A second area of study will be the Raman spectra of hydrogen and deuterium. The purpose of studying hydrogen in a molecular beam is to improve significantly the precision of the measured Raman vibrational frequencies and to verify the isotopic shift of the molecular vibration which is a direct test of the validity range for the Born-Oppenheimer approximation.

This research is a continuation of that currently supported by Foundation Grant, CHE-7621987.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, EXCITED QUANTUM FLUIDS IN SOLIDS

C.D. Jeffries, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005929 TICNO; 4070)

Studied are phenomena arising when light strikes matter, in particular semiconductors like germanium, at low temperatures. Electrons are excited into higher states leaving vacant states, or holes. At sufficient densities, excitons condense into a metallic electron-hole liquid, a novel state of matter. Also studied are: (1) droplet nucleation; (2) surface tension effects; (3) gas-liquid coexistence curves and phase diagram; (4) kinetics of formation and decay; (5) motion and spatial distribution of free excitons and drops under pulsed and steady excitation; (6) unusual explosive formation kinetics at high excitation; (7) unusual optical

hysteresis and optical nonlinearities of the gas-liquid system; (8) and the possible transient existence of biexcitons and higher excitonic molecules during the nucleation of the liquid.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0007, CROSSED MOLECULAR BEAMS
Y.T. Lee, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005957 TICNO; 4024)

The research program includes: (1) investigation of the dynamics of elementary atomic and molecular processes and the energetics of exotic radicals, ions and ion clusters using the crossed molecular beams method; (2) information on mechanism and dynamics of chemical reactions obtained from the direct identification and measurements of velocity and angular distributions of product molecules from single collisions; (3) reactions of oxygen atoms and free radicals with carbon-containing molecules and radicals using the molecular beams method; (4) identification of primary products of many important reactions of combustion; (5) hyperthermal chemical reactions of hydrogen, deuterium and halogen atoms; (6) reaction of electronically excited atoms and molecules; (7) interaction potentials between atomic and molecules species; (8) inter- and intramolecular energy transfers; (9) the synthetic studies of the energetics of radical molecules; (10) the determination of the structure of gaseous molecular ions by infrared absorption spectroscopy; and (11) the dynamics of photodissociation of polyatomic molecules by single and multiphoton processes and the determination of proton affinities of polyatomic molecules by molecular beam photoionization of van der Waal's molecules.

BIBLIOGRAPHIC REFERENCES: Becker, C.H., P. Casavecchia and Y.T. Lee, Crossed Molecular Beam Studies on the Interaction Potentials for F(/sup 2/P) plus Ne, Ar, Kr (/sup 1/S), J. Chem. Phys. 70: 2986 (1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0008, CHEMICAL STRUCTURE/BONDING DECOMPOSITION RELATIONSHIPS
R.C. Dorey, U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab., *Air Force Academy, Colorado Springs, Colorado* 80840 (DF281610)

AF function - rocket propulsion, weapons, conventional, high explosives. Deficiency - existing technology is insufficient to adequately predict compatibility and aging characteristics of energetic materials. Research - to correlate chemical structures with decomposition mechanisms, thermal et al. How research contributes -provides a basic understanding of structure property relationships on which to base prediction of compatibility, aging and detonation properties. Abstract - kinetics and product analysis of decomposition of energetic materials will be investigated. Emphasis will be placed on decompositions induced thermally, by electron impact and by shock. Isotopic labels will be used to delineate mechanisms. Both model compounds and commercial materials will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

3.0009, NEGATIVE ION SPECTROSCOPY
W.C. Lineberger, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (CHE78-18424)

This research is in the area of quantum chemistry. Dr. Lineberger will continue to develop and exploit laser spectroscopy of negative ions to obtain electron affinities, bond strengths, and dynamical information on the photophysics of negative ions. A Nd-laser pumped dye laser system will substantially extend the range of his capabilities both in the infrared (to 4 microns) and the ultraviolet (to .21 microns). Experiments will be carried out using both tunable laser spectroscopy and photoelectron spectrometry which should unequivocally determine the singlet-triplet splitting in methylene. A new sputter ion source will be developed to investigate properties of metal clusters, with special emphasis placed on the transition from gas phase to solid phase. In a later stage of this program, he plans to use photodetachment to prepare state-selected free radicals, which will then be studied by laser fluorescence spectroscopy. Finally, he plans to extend his studies of intramolecular radiationless processes by observing energy redistribution under collision-free conditions in a pulsed molecular beam.

This research represents a continuation of that currently supported by Foundation grant CHE7501565.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0010, SiC FIBER REINFORCED GLASS - GLASS CERAMIC MATRIX COMPOSITES
J.J. Brennan, United Technologies Corp., United Technologies Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN875788; N00014-78-C-0503)

The use of fiber reinforced composite materials in naval aircraft is increasing because of their low density, high strength, and stiffness. It is anticipated that a number of advanced applications such as advanced gas turbine engines, diesel engines, and stable structures for satellites will require new composite materials with higher temperature capability and improved dimensional stability. The objective of this task is to study composite systems that offer potential for use at higher temperatures.

A comprehensive fabrication parameter study of composites composed of SiC monofilament and SiC yarn incorporated into high temperature glass or glass-ceramic matrices will be conducted. Fabrication parameters, such as hot pressing temperatures, pressure, time, and atmosphere will be studied and their effect on composite density and microstructure investigated. The microstructure of processed composites will be characterized. Mechanical strengths will be measured and fractographic analysis carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0011, LOCALIZED ELECTROCHEMICAL CORROSION CELLS (15539-MS)
B.F. Brown, American University, School of Arts & Sciences, Dept. of Chemistry, *Mass. & Nebraska Aves. N.W., Washington, District of Columbia* 20016 (DA0F9298; DAAG29-78-G-0165)

To determine the solution chemistry of electrolytes existing in localized corrosion cells (e.g., pits and propagating stress corrosion cracks), and to investigate the corrosion behavior of metals in these solutions. Relevance: The research has relevance to inhibition of corrosion and catastrophic failure in aircraft, mobility vehicle structures and lightweight armor.

Macroscopic cells will be utilized which contain the concentrated electrolyte as determined by experimental measurements on solutions in propagating cracks in aluminum and other metals. Aluminum and other metal specimens will be exposed to the concentrated electrolyte to determine corrosion response, effect of environment on rate of repassivation of newly exposed surfaces, and electrochemical reaction kinetics of the specimen electrodes as a function of electrolyte chemistry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, TRANSFORMATIONS OF NITROGEN OXIDES
G.S. Samuelsen, U.S. Dept. of Defense, Air Force, Office of Scientific Research, *Bolling Air Force Base, N P Bldg. 410, Washington, District of Columbia* 20332 (DF336380)

To investigate chemical transformations of NOX during sampling of gas turbine engine exhaust. Such transformations may cause present measurement methods to yield erroneous results. Object: This study is to define the conditions under which transformations take place and identify measures to minimize any sampling error so introduced. These results will be used to correct/validate measurements used to insure that af weapons systems meet the emission goals promulgated by AFR 19-1.

First year effort will identify the effects of sample pressure, residence time and probe condition on NOX concentrations, survey typical hydrocarbon concentrations in turbine engine exhaust, and develop techniques for studying high temperature ef-

fects. Second year effort will investigate transformations of NOX at high temperatures and with typical hydrocarbon concentrations, and will determine the effect of prolonged probe conditioning and the use of inert probe materials to maintain sample integrity. The final report will provide a determination of the adequacy of present USAF measurements of NOX and define procedures for increasing their accuracy.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0013, MATERIALS MODIFICATION AND ANALYSIS BY ION BEAMS

J.W. Butler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680023)

The objective of this work is to investigate the influence of ion implantation on the mechanical properties of materials used in thermostructural applications, e.g., alloy stability and ductility of materials under various loading conditions encountered in service.

The approach includes three phases (1) parametric studies of the effect of implanted dose, ion species, and depth of implantation, (2) macroscopic tests of mechanical properties of implanted samples, and (3) microstructure analyses, such as electron microscopy, Auger electron spectroscopy, ion beam analysis, and X-ray analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0014, ELECTRONICS MATERIAL SURFACE STUDIES

R. Kaplan, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980022)

To obtain a basic knowledge of the physics and chemistry of electronic materials, particularly of those aspects involved in providing the development and characteriation of materials needed for high performance and/or less expensive electronic and optical devices and components. To study surface and interface effects in current materials and electronic structures. To investigate new materials and techniques with regard to their surface and interface characteristics and utility.

Leed, auger, energy loss and photoresponse spectroscopies are used in ultra-high vacuum to study surface and interface crystal structure, electronic structure, and interaction with gases. Etching and deposition are performed and studied in situ. Transport and optical techniques are used to study free carrier energy bands and defect states in semiconductor substrates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0015, BONDING AND ELECTRONIC STRUCTURE

B.M. Klein, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480159)

Using the results of first-principles electronic structure calculations: 1) study theoretically the properties of existing materials to obtain a unified picture of the relationship between these properties and the chemical bonding; 2) from the knowledge gained, attempt to predict compositions and perfection of materials with enhanced desirable properties.

First-principle band structure techniques such as the augmented-plane-wave, discrete-variational, and Gaussian-plane-wave basis-set methods are used to calculate the electronic structure of elements and compounds. The results of these calculations, electronic energies and wave functions, are used with the appropriate theory and computer codes to calculate the properties of interest. These include elastic constants, thermal expansion, phase diagrams, effects of impurities, superconducting, and magnetic properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0016, CHEMISTRY OF TEMPERATURE STRESSED OILS (CO-OP)

H. Ravner, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680375)

To improve the capability and maintainability of present and future Navy aircraft turbine engines by developing more stable lubricant formulations. This will require a better understanding of the chemical processes involved in the degradation of heat and oxygen-stressed lubricant base stocks and additives.

The development of more efficient high-temperature lubricants will be investigated along three main lines: a) the role of organic and metal-containing contaminants in decreasing the oxidative stability of a lubricant, b) the use of more oxidatively stable polyesters for base stocks, and c) the use of more effective antioxidants.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0017, PHASE TRANSFORMATION IN SOLIDS

E.F. Skelton, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620076)

To examine selected physical properties of various materials under varied thermodynamical conditions with the ultimate objective of identifying and characterizing new materials or new forms of materials with superior utilitarian properties for ultimate application in naval systems.

Unique variable pressure and temperature fabrication and testing facilities including, inter alia, a massive 80 KBAR tetrahedral press and a one-of-a-kind low temperature x-ray/mutual inductance diamond-anvil pressure cell, are employed. Data analyses are supplemented and enhanced by theoretical model calculations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0018, SURFACE SPECTROSCOPIES FOR SOLIDS

R.R. Smardzewski, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780001)

Develop new techniques for determining the chemical compositions of surfaces and interfaces.

The means to acquire chemical, as opposed to elemental, information from surfaces is very limited. X-ray photoelectron spectroscopy (XPS) is well established but limited Auger electron spectroscopy (AES) is being developed as a direct probe of local valence electron density. Secondary ion mass spectroscopy (SIMS) is being developed as a mass base approach. Surface enhanced Raman (SER) and Fourier transform infrared (FTIR) are being developed as vibrational level probes. Laser-induced fluorescence and laser-induced desorption are under evaluation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0019, TECHNOLOGY OF LAYERED MAGNETIC MATERIALS

D.W. Forester, U.S. Dept. of Defense, Navy, Naval Research Lab., Electronics Technology Div., *Washington, District of Columbia* 20375 (DN080065)

To expand the technology base of single or multi-layered magnetic/composite material structures and magnetic surface phenomena. Exploit and improve properties which enhance the sophistication, reliability or cost effectiveness of Navy hardware and devices.

Layered structures such as metallic or insulating thin films, liquid phase epitaxy single crystals, bulk-sprayed composites and laser-processed surfaces are fabricated to achieve desired magnetic properties or phenomena. These are studied using techniques including auger and other surface analyses, ferromagnetic resonance, Mossbauer, magnetization, magnetostriction, X-ray and other structural methods. Fundamental bulk and surface

properties are investigated with and without incorporation of various gas phase constituents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0020, WEAR RESISTANT COATINGS FOR TITANIUM ALLOYS

B. Fishten, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN890233; N00019-79-C-0544)

Protect titanium alloys from degradation under conditions of wear, fretting and environmental embrittlement without adversely affecting other properties.

The final phase of this four-year program will use data and procedures developed for producing wear resistant coatings on titanium and wear/corrosion resistant coatings on steel. It shall scale up and demonstrate coating procedures on selected aerospace components and perform functional testing on these parts. Detailed evaluation of the influence that dried film lubrication has on the wear resistance of Cr-Mo plated titanium and steel shall also be accomplished. This phase shall provide details of coating procedures which produce coatings meeting specification requirements described in phase 3. Quality assurance methods to assure correct deposits will be considered. This will include plating bath composition control, plate thickness measurement techniques, and surface finish control.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0021, WEAR RESISTANT COATINGS FOR TI ALLOYS

Fishter, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN890147; N00019-78-C-0489)

To develop wear resistant coatings for titanium alloys.

Develop chromium-molybdenum electroplating techniques for titanium and iron-based alloys.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0022, SYNTHESIS OF POLYHEDRANES AND POLYHEDRAL CARBORANES (17398-C)

R.B. King, University of Georgia, Franklin College of Arts & Sciences, Dept. of Chemistry, *Athens, Georgia* 30601 (DA0G2990; DAAG29-80-K-0030)

To develop new synthetic materials for the synthesis of polyhedral carboranes and polyhedranes. Relevance: The compounds to be prepared have high relevance to areas of vital Army interest. Potential use in high density explosives, travelling charge propellants, and in pyrotechnic, primer, and burning rate catalytic applications are envisaged.

The following areas of chemistry will be investigated: (1) thermal and photochemical reactions of borane metal carbonyls with alkynes; (2) photochemical reactions of alkyne metal complexes with boranes; (3) preparation of metal complexes containing two or three B3H8 ligands; (4) reactions of metal vapors with BH3l and B3H7l derivatives; (5) photolysis of LI2C2; and (6) the reactions of transition metal complexes with cyclobutadiene and triquinocene ligands.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0023, THEORY OF GAS PHASE DYNAMICAL PROCESSES

J.C. Light, University of Chicago, Graduate School, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (CHE79-06896)

This grant under the Quantum Chemistry Program supports research dealing with collision processes in the gas phase. Most of the work will involve four major projects as follows: (1) accurate quantum calculations of reactive scattering information (cross sections, resonances, energy distributions) for simple asymmetric chemical reactions; (2) technical improvements of the R-matrix propagation method for solution of close coupled equations and extensions of the method to encompass and improve various approximate approaches; (3) development and application of sudden or angular momentum conserving approximations for reactive scattering; (4) investigation of charge transfer and electronically nonadiabatic collision processes. These projects are central to advancing the field of computational quantum dynamics which holds the promise of providing detailed information about molecular scattering processes.

This grant is a renewal of research currently supported by NSF grant CHE-7611809 at the University of Chicago.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0024, LASER-INDUCED CHEMICAL REACTIONS AND LASER-COLLISION PROCESSES

J.C. Light, University of Chicago, Office of Sponsored Programs, *Chicago, Illinois* (AC02-78ER04908)

There now exist lasers powerful enough to affect the dynamics of atomic and molecular collisions in the gas phase. These processes differ from those observed when collision partners are prepared (by lasers) in specific internal states before collision, in that the photon field couples different states during the collision processes. Model systems were used to estimate the effects of non-resonant radiation on atom-diatom reactions and the effects of collisions on the absorption of infrared radiation within a vibration-rotation manifold. For fields on the order of 10/sup 8/--10/sup 10/sq cm, these effects become prominent, and apparently have been observed with small probability at much lower fields. In addition, an exact (and efficient) quantum method has been developed for polyatomic dissociation. Fano-type resonance structure in the probability versus frequency plots for specific initial and final states (model CO2(v,j) plus h nu yields O plus CO(v',j')) has been predicted. These studies will be extended to more realistic 3D systems and to multiphoton processes.

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

3.0025, PHYSICAL CHARACTERIZATION OF ELECTRONIC MATERIALS

A.S. Kulin, Manlabs Inc., *21 Erie St., Cambridge, Massachusetts* 02138 (DF904130; F19628-78-C-0060)

AF function - command, control and communication. Deficiency -present device performance reliability and lifetime are affected critically by surface and interface recombination processes. The objective is to conduct a research support effort on the characterization of specific physical, chemical and structural properties of solid state EM materials. How research contributes - these studies will produce samples and specimens of solid state materials which will be precisely oriented, cut and polished to RADC/ET specifications. These materials will then be used by RADC/ET personnel in their research to provide more reliable electronic devices for command, control and communication systems.

The techniques to be used will include X-ray diffraction and crystallography, electron microscopy (including scanning and transmission), electrical measurements and metallography. Typical materials to be processed will include quartz (natural and synthetic), silicon, InP and other materials of electronic importance. Perform research using electron beam microprobe techniques to determine quantitatively trace concentrations of dopants such as antimony (Sb), germanium (Ge), phosphorous (P), iron (Fe), and copper (Cu) in a glass matrix. The distribution of

these dopants will be determined as a function of position within the glass matrix. It is expected that the concentration of dopants in the glasses will range from 10 percent to 0.001 percent.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0026, TURBULENCE PHENOMENA IN METALS PROCESSING

J. Szekely, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-24692)

This is a fundamental investigation of turbulent recirculating flow phenomena, such as occurs in metals processing operations. The program includes: (1) experimental work using a laser doppler anemometer to determine the velocity fields and the turbulent fluctuations in water models and in transparent molten salt models; (2) interpretation of industrial data obtained from commercial measurements on molten steel in forty- and sixty-ton ladles; and (3) numerical solutions of the turbulent Navier-Stokes equations using improved computational algorithms with emphasis on more realistic boundary conditions at the melt-gas interface. It is expected the results obtained will enhance understanding of metals processing which depend upon the coupling of reaction kinetics, fluid flow, and mass transfer phenomena in systems involving contact of liquid-liquid and liquid-gas phases.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0027, METAL INSULATOR TRANSITION MATERIALS

W.J. Croft, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0F4799)

The Army has a continuing need for very simple and rugged electronic devices of high reliability. The reduction of the number of components in a device to the absolute minimum for operation enhances the system reliability. Metal-insulator transition compounds represent the simplest solid state devices for thermal switching of electric current - a single phase of a simple material that undergoes a large change in conductivity at the transition temperature. A typical material that undergoes this Mott transition is vanadium dioxide which is being studied in detail.

This program will be concerned with the adaptation of the most suitable of the metal-insulator compounds to aircraft and missile applications. Consideration will be given to volume and current carrying capacity requirements for the several temperature ranges. Polycrystalline materials are being prepared by solid state reaction in order to measure the bulk properties. Crystals are being grown by direct reduction of molten oxides and also by chemical vapor transport. Properties of these crystals are being compared with each other. stability with temperature cycling, and effects of pressure and stoichiometry will be investigated. Efforts will be made to increase the size and perfection of the grown crystals.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0028, ADVANCED AIRCRAFT STRUCTURAL SKINS

T.V. Hynes, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0H4679)

Previous research has evolved designs for lightweight/high strength skins which address a multiplicity of actual and potential blast, ballistic, radar and high-energy laser threats. This work unit will develop a specific design to meet the mechanical load requirements of the system and integrate specified levels of laser protection and significant levels of radar levels of radar camouflage. Designs will be fabricated and tested in panel configuration.

Mechanical requirements will be specified and an initial composite design developed based on the generic designs previously tested. An electrical design compatible with the mechanical configuration will be developed and the design relaxed to allow radar bandwidth and attenuation to be optimized. An improved mechanical design to meet flight load specifications. A second iteration of the design to re-optimize the radar properties will be made. The mechanical design will be constrained to be compatible with blast and ballistic protection. Materials will be chosen for high energy laser resistance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0029, IMPROVED REACTION SINTERED CERAMICS FOR ENGINES

D.R. Messier, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0C4794; N/A)

The use of ceramic components in engines inevitably involves compromises between factors such as ease of fabrication and low cost vs. optimum corrosion, erosion, mechanical and thermal properties. The objective of this program is to develop improved, economical ceramic materials for future Army power generation and propulsion applications. Although this work is specifically related to the use of ceramic components in the MERADCOM 10 kW turboalternator, it also relates to pacing materials problems in aircraft (turbine components- 14.2, 15.2, 15.7, 15.11 in FY76 guidance), armored vehicles (combustor, power turbine, and regeneration for 1370 degrees C TIT), and problems in surface mobility and craft and missile materials. The major thrust is mobility equipment (heat engines).

Although reaction bonded silicon nitride is an inexpensive, fabricable material with considerable potential for use in the nozzle and combustor sections of the 10 kW turboalternator, its resistance to corrosion and erosion is marginal for such use. A method is being developed to produce coatings of silicon and silicon nitride on the material to overcome these deficiencies. Coating parameters are presently being optimized, and coated specimens will be fabricated for corrosion, erosion, and mechanical testing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0030, CORROSION CENTER FOR RESEARCH AND TECHNOLOGY TRANSFER TO ENERGY SYSTEMS

W.W. Gerberich, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Chemical Engineering & Materials Science, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (004777 TICNO; 0630-5500)

Principal objectives of the DOE Corrosion Center are attracting a broad range of researchers to the study of corrosion, developing quantitative prediction models having broad application to the energy industry, and providing effective transfer of technology. The approach to this objective is to join researchers from the basic sciences, physics and chemistry, and the engineering disciplines, electrical, chemical, materials, and mechanical engineering, to solve the various degradation problems using the most modern-surface analytical techniques. Imparting this basic scientific information to students, industrial researchers, engineers and designers will be accomplished through technology transfer based upon visitation programs, symposia, short courses, seminars, and media dissemination. Progress the first year was largely organizational with regards to establishing a management structure, selecting a director, awarding internal research proposals (17), selecting capital equipment (5 major items), and initiating technology transfer. Initial development of plasma deposited polymer films or multi-layered ceramic-metal coatings for resistance to aqueous corrosion or high temperature sulfidation are underway. Progress in applying Auger spectroscopy, IR spectroscopy, ESCA, non-dispersive X-ray, X-ray diffraction, and STEM techniques to coating, interface and bulk

metal systems critical to the understanding of corrosion and corrosion protection was also accomplished.

SUPPORTED BY U.S. Dept. of Energy, Materials Sciences Div.

3.0031, ENERGY AND MOMENTUM EXCHANGE BETWEEN SOLIDS AND GASES

L.B. Thomas, University of Missouri, Columbia Campus, Graduate School, Dept. of Chemistry, *205 Jesse Hall, Columbia, Missouri* 65201 (DF042550; AFOSR-76-2934)

AF function - aerospace vehicles. Deficiency - lack of knowledge of interactions of gas molecules with solid surfaces. Objective - to complete additional measurements of clean-surface tangential momentum accommodation coefficients on magnetically suspended, spinning balls, and to analyze and prepare for publication a large body of data compiled from the previous work of the principal investigator on momentum and energy accommodation on surfaces of known cleanliness or known coverage with gas molecules. How work contributes - by making generally known the physical details of these interactions and the conditions governing them, it should be possible to make more accurate a-priori predictions of aerodynamic forces as well as to be better able to design around gas contamination processes on spacecraft carrying optical and infrared or ultraviolet sensors or emitting devices.

A large body of raw data accumulated from previous measurements of thermal accommodation coefficients by the principal investigator will be corrected and prepared for publication using recently accomplished measurements of mercury pumping effect and temperature distribution on tungsten filaments. Some additional data points will be taken to complete certain sets of data. Tangential accommodation coefficients will be measured by the magnetically suspended spinning disc method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0032, KINETICS OF SOME METAL ATOM AND METAL FLUORIDE OXIDATION REACTIONS

W. Felder, Aerochem Research Lab. Inc., *P.O. Box 12, Princeton, New Jersey* 08540 (DF047530; F49620-77-C-0033)

AF function - rocket propulsion. Deficiency - performance of rocket and aircraft propulsion, including exhaust plumes, are among the Air Force technologies in which progress is hampered by lack of reliable data on some of the basic chemical species and processes, especially those in projected future systems. Objective - in this work, rate coefficients will be measured over a wide temperature range for the reactions of light-metal vapors with specific oxidants. How work contributes - the fundamental reaction rate data obtained will be directly usable in advancing the technologies of afterburners, ramjets and rockets, and their exhaust plume radiation.

The unique capabilities of the Aerochem Research Laboratories high-temperature fast-flow reactors (HIFFR) will be used to make measurements of reaction rate constants, from as low a temperature as the particular reaction is fast enough to measure, up to dissociation temperature of the molecular reactant. Specific reactions to be studied between metal atoms and gaseous oxidizers are being selected to correspond closely with Air Force technology needs. The following reactions are being studied - magnesium, boron, and aluminum monofluoride with oxygen, and aluminum with nitrogen trifluoride.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0033, MICROSTRUCTURAL ANALYSIS OF SURFACE LAYER AND ITS EFFECT ON CRACK PROPAGATION

S. Weissmann, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Materials Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DN775284; N0014-77-C-0191)

Alloys used in naval systems ofter fail by a corrosion fatigue mode, and the ability to predict when a part will fail by corrosion fatigue would be a great asset. However, this predictive capability does not presently exist. This research is an attempt to provide such a capability.

X-ray rocking curve measurements and line broadening measurements will be investigated to determine their feasibility as means to non-destructively assess the cumulative damage (dislocation density) in alloys subject to corrosion fatigue and stress corrosion. It is proposed to test the theory that cracking occurs when the surface stress due to excess dislocation density reaches a specific value dependent only on the alloy. Selected steels, aluminum, and titanium alloys are to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0034, TIME RESOLVED STUDY OF PRIMARY DECOMPOSITION PROCESSES FOR NITRO PARAFFINS AND NITRAMINES (16950-C)

E.R. Grant, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (DA0G2071; DAAG29-80-C-0065)

To develop a new instantaneous detection technique based on the phenomenon of resonance enhanced multiphoton ionization to examine the primary dissociative properties of nitroparaffins and n-nitroamines. Relevance: The understanding of both mechanisms and rates of dissociation of energetic molecules used as explosives and propellants is of substantial interest to the missions at LCWSL, BRL and MICOM.

Molecules of interest (nitroparaffins and n-nitroamines) will be excited to dissociation by infrared laser induced multiphoton absorption. The excitation process will be pulsed enabling time resolved measurement. A pulsed visible/UV dye laser will be employed to selectively detect and identify decomposition fragments with confirmation by mass analysis. A high resolution pulsed molecular beam photofragment spectrometer will be configured based on these techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0035, STRESS INDUCED HYDROGEN CONCENTRATION CHANGES IN TITANIUM (PHASE III)

P.N. Adler, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF043350; F44620-76-C-0071)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Opportunity - stress-induced hydrogen concentration changes appear to be basic to this problem. Objective - this research will determine the extent and kinetics of the hydrogen redistribution that takes place in titanium alloys under the influence of elastic and plastic deformation. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of our important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Objective will be accomplished using Grumman's recently developed lithium nuclear microprobe (LNM) technique that enables in situ hydrogen concentration measurement in the surface of samples while under an applied stress. The results of these measurements will permit evaluation of the manner by which hydrogen participates in crack propagation and embrittlement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0036, THE MECHANISM OF FRETTING FATIGUE CRACK INITIATION IN MEDIUM STRENGTH STEELS (15979-MS)

D.J. Duquette, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Metallurgical Engineering, *110 8th St., Troy, New York* 12181 (DA0G8994; DAAG29-79-C-0013)

To perform systematic studies of the basic mechanisms of crack initiation in fretting-corrosion-fatigue. Relevance: Fretting and its extensions in fretting-corrosion-fatigue have been of serious consequence in engine and rotating sturctural components of Army aircraft. Such phenomena may also be responsible for some classes of problems in high-rate-of-fire weapons, and in ground vehicular components.

Experiments will be performed on a 4130 steel which develops a wide range of structures and properties upon heat treatment. Variables to be studied include differential hardness of faying surfaces, amplitude of slip, frequency, environment, temperature, and surface hardness.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0037, ELASTIC-PLASTIC DEFORMATION IN CRACKED SOLIDS AND DUCTILE CRITERION (15226-E)
H.W. Liu, Syracuse University, L.C. Smith College of Engineering, Dept. of Chemical Engineering & Metallurgy, *Link Hall, Syracuse, New York* 13210 (DA0F9176; DAAG29-78-G-0069)

To develop a ductile fracture criterion and a rational testing procedure for fracture toughness measurements. Relevance: This research is important in the analysis and design of Army structures and materiel particularly since lightweight, ductile and tough materials are needed for helicopter and lightweight armor.

An experimental and numerical analysis on crack tip deformation and crack tip stresses will be carried out on bending and tension specimens.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0038, WAVE PROPERTIES OF HETEROGENEOUS MATERIALS
R.L. Mills, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-11770)

Research previously supported by DMR76-10846.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the properties of heterogeneous materials. Some of the topics to be investigated will include: (1) The propagation of mechanical waves in composite media. (2) The determination of elastic moduli of porous solids. (3) The development and application of a generalization of the coherent potential approximation, known as the 'traveling cluster' approximation. (4) The application of multiple-scattering theory to electromagnetic wave propagation in composites.

This research will enhance the understanding of heterogeneous materials, such as metallic alloys, multiphase solids and composite materials of geophysical and metallurgical interest.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0039, EVALUATION OF SPECIAL AVIATION TURBINE FUELS PRODUCED FROM PETROLEUM, COAL AND OIL SHALE
C.L. Delaney, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF457580)

Establish an engineering data base that can be used to support decisions made to increase aviation turbine fuel availability. Near term decision will have to be made relative to changing property requirements of military fuel specifications as a means of increasing aviation turbine fuel yield from petroleum resources. Mid- and far-term decisions will have to be made relative to developments and use of aviation turbine fuels from coal and oil shale resources. Use of aviation turbine fuel derived from coal and oil shale will involve further decisions relative to changing specification requirements to accommodate the different chemistry and economics associated with development of these resources.

Data generated under previous effort (Work Unit 30480753) along with additional data to be obtained in this effort will be used for assessing aircraft fuel system vulnerability to laser threats. Effects of laser threats on current protection techniques, such as fully-packed reticulated polyurethane foam and nitrogen inerting, will be determined, and if required, new protection techniques will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0040, EQUIPMENT FOR CROSSED MOLECULAR BEAM STUDY OF 1,2 DIOXETANE DECOMPOSITION
C.C. Kahler, Swarthmore College, Graduate School, Dept. of Chemistry, *Swarthmore, Pennsylvania* 19081 (CDP80-18020)

The application of photon detection to the study of reactions using the crossed molecular beams technique is helping provide information on what role various forms of energy (e.g., vibrational, translational) play in promoting a reaction. Because most of the work to date has been done on diatomics and triatomics, a photon detection crossed molecular beam machine will be constructed to extend this information to include reactions involving organic molecules. The machine will have a supersonic beam crossing a quasi-effusive beam with the light from the collision zone focussed on a photomultiplier. The goal of the first project is to study the effect of translational, resonant internal and non-resonant internal energy transfer on the decomposition of 1,2 dioxetane derivatives.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management, Div. of Budget & Program Analysis

3.0041, RD&D - ADVANCED CHEMICAL MEASUREMENTS TECHNOLOGY
C. Feldman, U.S. Dept. of Energy, Oak Ridge National Lab., Analytical Chemistry Div., *P.O. Box X, Oak Ridge, Tennessee* 37830 (AK-01-03-02-3; W7405-ENG-26)

The objective of this program is to utilize emerging technology from all scientific disciplines to extend the limits of chemical measurement methodology. Particular emphasis is given to techniques that result in increased speed, efficiency, accuracy, lowered detection limits, and multicomponent analysis. A previously designed arc emission detector will be combined with a new background correcting system for use in gas chromatography. This combined detection scheme will be used to eliminate spectral interferences from organic compounds in multicomponent analyses. The system is also being used to study organo-fluorine materials. This is an application area where conventional detectors frequently fail. The development of resonance ionization spectroscopy has continued to show great promise as a research tool. Work on the basic chemistry, radiochemistry, and spectroscopy of the transuranium elements will continue. This work has led to new measurement methods for these elements and their compounds. A new effort will be initiated in the area of laser-induced fluorescence and its application to the analysis of materials at the picogram level. First work will be directed toward the development of supersonic beam fluorescence for gas phase analysis. (ORNL/CF-78/111)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

3.0042, VIBRATIONAL ENERGY TRANSFER IN GASES
G.P. Glass, Rice University, Wiess School of Natural Sciences, Dept. of Chemistry, *6100 Main, Houston, Texas* 77001 (C-312)

A discharge flow shock tube has been used to study, in isolation, the reaction between atomic hydrogen and carbon dioxide over the temperature range, 1471-3175 K. The concentration of atomic hydrogen, which was usually present in large excess, was measured using a chemiluminescent tritration reaction, and carbon dioxide was monitored throughout the reaction by infrared emission spectroscopy.

The rate constant for the reaction, H plus CO2 yields OH plus CO, was found to be pressure dependent, especially at

higher temperatures. The reaction rate was first order with respect to carbon dioxide, but less than first order with respect to atomic hydrogen. At lower pressures (approximately 200 torr) the Arrhenius plot exhibited marked curvature.

A detailed molecular mechanism involving a stable intermediate species, HOCO, has been postulated in order to account for the above observations. The consequences of such an intermediate being formed in hydrocarbon combustion systems are discussed.

SUPPORTED BY Robert A. Welch Foundation

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ADVANCED IMAGE COMPRESSION TECHNIQUES (TMP213)

D. Tseng, Hughes Aircraft Co., Hughes Research Laboratories, *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DA0G2858; DAAK70-79-C-0189)

To develop techniques for imagery compression ratios on the order of 10,000 to 1 for use in RPV missions.

Imagery of RPV type scenarios will be subjected to simulations of classification algorithms. The image will be coded into coordinates and descriptors for reassembly of a synthetic image.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Night Vision & Electro Optics Lab.

4.0002, EPITAXIAL GARNETS AND HEXAGONAL FERRITES

H.L. Glass, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DF040600; F49620-79-C-0048)

AF function - microwave electronic components are essential elements of Air Force communications, reconnaissance, surveillance and countermeasures systems. Opportunity - improved performance can be expected from the use of new solid state materials for processing microwave signals. Present microwave solid state signal processing devices which utilize surface acoustic waves (SAW) cannot operate at frequencies greater than a few hundred MHz without encountering difficulties. These difficulties, which include high attenuation and extremely small transducer geometries, are compounded by poor coupling efficiency from electromagnetic to acoustic energy. Objective - the objective of this research is to develop epitaxial layers of yttrium-iron-garnet (YIG) and hexagonal ferrites for utilization in magnetostatic surface wave signal processing devices that operate in the 1 to 25 ghz and 25-60 GHz frequency range, respectively. How work contributes - the research involves the growth and characterization of epitaxial, low-loss temperature compensated YIG films and device quality hexagonal ferrite epitaxial layers. Graded and multiple layer films are also grown for improving device performance.

Refinement of the LPE techniques used to grow special layered structures will continue along with a theoretical and experimental microwave analyses to define the capabilities of these structures for improving signal processing device characteristics, in particular increased bandwidth in non-dispersive delay lines and time-bandwidth product in linearly dispersive delay lines. The microwave analysis will relate device characteristics to those material parameters that are controllable through the LPE process. Epitaxial hexagonal ferrites will be investigated for use in devices operating at frequencies above 25 GHz. The quality of LPE materials is limited by the quality of the substrate crystals. Substrate quality will be investigated and the affect of defects quantified. The investigation of LPE growth of hexagonal ferrites will use substrates grown under ARO and in-house funding. The objective of the ARO program is to prepare low-linewidth LPE layers of M-type hexagonal ferrite. Hexagonal ferrites that are tailored to meet specific device requirements at specific operating frequencies will be sought in the present work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, PATH INDEPENDENT INTEGRALS AND FRACTURE MECHANICS

G. Herrmann, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF058200; AFOSR-80-0149)

AF function - aerospace vehicle structures. Opportunity - path independent conservation integrals promise both fundamental insight into the mechanical behavior of cracks, voids and other defects in structural materials, and a practical means for accurate engineering/design computations. Objective - to improve understanding of basic phenomena of fracture and failure, and to improve computational methods for analysis and design. How work contributes - develops and strengthens the mathematical and mechanical foundations upon which path independent integrals are built. Extends solid mechanics applicability to dynamic, nonlinear elastic and thermoelastic cases.

Begin by considering elastic continua, in both the material coordinate and the spatial coordinate description, allowing deformation gradients which are unsymmetrical as well as velocity- and time-dependent. Develop the conservation-integral for these continua from first principles, using deformation gradients rather than displacement gradients, for transparency in structure and meaning. Generalize, where possible and fruitful, to nonlinear elastic materials, and to thermoelastic and elastodynamic problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, TRANSITORY STALL IN DIFFUSERS

J.P. Johnston, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DN975340; N00014-79-C-0255)

The objective of this study is to improve current knowledge on the fluid dynamic behavior of the transitory stall regime in straight two-dimensional diffusers. Such information is needed to better control detrimental unsteady flow effects associated with peak diffuser performance in aircraft turbojet engines, and ultimately should lead to improved propulsion systems for naval weaponry applications.

Experiments will be run in a two-dimensional test facility for symmetric diffuser configurations having a length-to-width ratio of 15 and opening angles in the transitory stall regime. Mean flow and turbulence measurements will be made with hot-wire anemometers, and wall boundary layer separation will be studied using a newly-developed wall-layer, flow-direction probe. Wall pressure fluctuations will be measured with wall-mounted transducers. A two-dimensional performance prediction method will be developed involving simultaneous computation of the separated and unseparated boundary layer and core flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, BASIC STRUCTURE AND PROPERTIES OF TURBULENT SHEAR FLOWS

S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF053840; F49620-79-C-0010)

AF function - advanced airbreathing propulsion devices. Opportunity -increase understanding of the basic flow structure and computational ability for turbulent shear flows. Objective - increase understanding of basic flow structure of separating and separated flows. Study of effect of wall curvature on these flows and also on heat transfer will be made. How work contributes - improvement in both physical understanding and prediction ability will permit better design of any system (jet engines, turbine blades, diffusers, airfoil sections) in which these flows become limiting or controlling factors.

A combined experimental and theoretical program on turbulent shear flows has been established. Studies will be made of

unseparated, separating and fully separated flows. Examination of transitory and fully stalled flows in diffusers will be accomplished. The effect of wall curvature on turbulence structure function and heat transfer will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, EVALUATION OF DATA SETS AND COMPUTING PROCEDURES FOR FLUID FLOW FIELD INVOLVING VISCID-INVISCID INTERACTIONS

S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF057390; F49620-80-C-0027)

AF function - advanced propulsion and aerospace vehicle systems. Opportunity-assessment of computational methods for viscid-inviscid flow fields. Objective - to collect, classify and assess data available for turbulent flow fields. How work contributes - will provide a basis for determining range and reliability of different computational methods developed for turbulent shear flows.

The first task will be the collection of data sets. Then it will be assessed for significance, and reliability. The data will be grouped into several related classifications in order to organize the topic and to relate data, computer models, and applications. Points to consider will include degree of low complexity, flow types, and related applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, CONTINUATION OF FUNDAMENTAL STUDIES OF UNSTEADY TURBULENT BOUNDARY LAYERS (16760-E)

W.C. Reynolds, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DA0G9153)

To experimentally study an unsteady attached and separating turbulent boundary layer under conditions in which the flow upstream of the unsteady region is a standard, steady, flat-plate boundary layer. Relevance: The research is relevant to the dynamic response of helicopter rotors and rotating compressors and turbine blades in helicopter engines.

A unique unsteady water tunnel will be used for a variety of flow conditions, and redundant measurements for mean, periodic and instantaneous velocites will be made by means of pitot tubes, hot-wire anemometers and laser velocimeters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0008, COHERENCE OF VORTEX SHEDDING IN SHEAR FLOWS

S.S. Sergev, U.S. Dept. of Defense, Navy, Civil Engineering Lab., Naval Construction Battalion Center, *Port Hueneme, California* 93043 (DN087332)

To investigate the correlation length of vortex shedding behind circular cylinders in sheared flows. The effects of variation of shear, Reynolds number, roughness, and yaw angle will be explored.

Cylinders of different diameters and roughnesses will be tested in a wind tunnel with varying velocities and degrees of shear. The flow downstream of the cylinders will be surveyed with a hot-wire anemometer to measure wake velocities and frequencies. Mean pressures around selected cylinders will be measured to determine the fluid forces on the cylinders. The data will be analyzed to define the coherence length of vortices shed in the different flow conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Facilities Engineering Command

4.0009, WAVE-PARTICLE INTERACTIONS ON RELATIVISTIC ELECTRON BEAMS

I.B. Bernstein, Yale University, School of Arts & Sciences, Dept. of Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DN975528; N00014-79-C-0588)

The Navy is interested in new methods of generating high power level electromagnetic radiation in the range from submillimeter to laser light wavelengths. A method of generating these high powers involves the use of relativistic electron beams. Consequently, quantitative information on mechanisms and wave particle interactions in relativistic electron beams is important.

The effect of non-ideal beam electron velocity distributions and their effective momentum spread on the gain of collective wave generation modes will be studied. A variety of magnetic pump configurations will be critically examined in order to discover the optimum configuration for maximum tunable power generation. The Vlasov and Maxwell equations will be solved analytically for several magnetic pump configurations including the case of a superposed uniform magnetic field, appropriate and needed for the case of intense relativistic electron beams of low voltage. The theoretical treatment will include thermal momentum spread occurring in present beam generators. Theoretical results on gain and bandwidth of various wave-particle interactions will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, MULTIANGULAR SCANNING ABSORPTION-EMISSION TECHNIQUES FOR 3-D COMBUSTION DIAGNOSTICS

R. Goulard, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DF049990; AFOSR-77-3439)

AF function - advanced diagnostic techniques, advanced airbreathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using multiangular scanning absorption-emission (MASAE) techniques for obtaining high-spacial and time-resolved 3-D mapping (point and profile) of species concentration and temperature in practical combustion environments, to determine capabilities and limitations of MASAE as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytical models of complex reacting flows, will help reduce development time and cost of airbreathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

The applicability of absorption-emission techniques as 3-D combustion diagnostics will be investigated. Using multiangular scanning, the traditional onion-peeling method will be extended from axisymmetrical flows to arbitrary distributions of radicals and pollutants in reacting flows encountered in actual 3-D airbreathing combustion systems. A convolution algorithm already proven in X-ray absorption tomography will be tested on typical pollutant and radical concentration profile maps in flames or exhausts. The effect of the number of scans, of the viewing angle limitation, of the instrument noise, will be analyzed for both parallel and fan beams. An optimized design will be proposed on the basis of these observations which will enable accurate measurement of the reacting flow field. The concept of an emission technique based on the instantaneous measurement of multiple fans from several windows will also be evaluated which can provide an instantaneous map of temperature and species concentration. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, SURFACE FILMS AND REMOTE SENSING

W.D. Garrett, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980246)

To determine the effects of oganic sea-surface films on remotely sensed signals and to relate these signals to film-induced modifications of specific air-sea interfacial properties. To select appropriate experimental slick-forming materials for use in MARSEN-I studies of surface film effects.

(1) Perform preliminary experiments in the Chesapeake Bay to enable the selection of experimental slick-forming material to (a) duplicate natural slicks, and (b) produce intense, persistent sea surface effects with maximum attenuation of capillary waves. (2) Acquire and deliver slick-forming materials to experimental site. (3) Participate in experimental slick operations and consultation during MARSEN-I.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0012, SURFACE ALLOYING OF BEARING AND GEAR STEELS BY ION IMPLANTATION

J.K. Hirvonon, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN889788)

To eliminate corrosion and improve reliability of bearings and gears.

By the use of corrosion testing, electrochemical potential measurements and bearing and gear simulated bench testing, ion species and concentrations will be optimized on currently used M50 bearing steel. After optimization full scale bearing life testing, engine testing and field evaluation testing will be conducted. A parallel effort will be conducted on implanting advanced bearing and gear materials for corrosion resistance followed by specimen and full scale testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0013, ELECTRONIC DEVICES & CIRCUITS FOR USE IN RADIATION ENVIRONMENTS

H.L. Hughes, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020143)

The objective is to improve the reliability of transistors, integrated circuits, and other semiconductor devices required to operate in nuclear radiation environments (nuclear-weapon and space environments). Such circuits and devices are required in Navy missile, satellite, and ship systems (e.g., DSP Trident, GPS, DMSP, MEECN, MX).

The approach is to develop a complete family of radiation-hardened CMOS/SOS, bulk silicon and NMOS LSI/VLSI circuits. The most radiation susceptible region of MOS devices is the insulator-semiconductor interface. Techniques to reduce the radiation sensitivity of this interface are being pursued. Silicon dioxide films with highly controlled electrical properties are being grown and deposited on silicon device substrates. LSI/VLSI fabrication techniques such as e-beam and x-ray are being investigated in terms of hardness.

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0014, NEAR-MILLIMETER WAVE TECHNOLOGY

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The near-millimeter wave (100-1000 GHz) spectral region is receiving increased attention by the Navy because of its potential for achieving high resolution and all-weather performance simultaneously. However, because of the small electromagnetic wavelength many conventional approaches to components and circuitry are not practical. The objective of this program is to develop novel approaches, especially for receiver oriented technology, which circumvent these limitations.

Novel negative resistance mechanisms, e.g. cyclotron resonance in semiconductors with non-parabolic conduction bands, will be investigated for producing near-millimeter RF energy. Kinch-Rollin, Josephson Junction and Super-Schottky detectors and associated circuitry will be studied with the goal of realizing an integrated cryogenic receiver.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0015, EXTREME ULTRAVIOLET ENVIRONMENT

C.S. Weller, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN120101)

The exploration, description, analysis, and understanding of the ultraviolet (UV) environment of the earth and space are quite important since, from a fundamental standpoint, the strong optical effects of atoms and molecules occur in this part of the spectrum. This has in the past and will continue in the future to give new insight and opportunities for investigating solar-terrestrial relationships, establishing the behavior of the upper atmosphere and plasmasphere and their interactions, the interstellar medium and its interaction with the solar system, and developing UV space surveillance.

Observational data acquired from NRL instruments on space vehicles such as the STP 72-1, OSO-8, and SOLRAD-11 satellites are analyzed and interpreted. New instrument probes are being developed with emphasis on spectral resolution in the extreme UV and imaging in the far UV.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0016, VLF LOOP ANTENNA WITH LOSSY CORE

R.W. Burton, Southeastern Center for Electrical Engineering Education Inc, *Orlando, Florida* 32809 (DF906950)

The objective of this effort is to furnish the Air Force command, control and communication mission with new antenna technology for an emergency worldwide communications link at VLF. This can be achieved by examining the radiation field and efficiency of a triangular ELF loop antenna wound around a mountain on an island in the sea and around a mountain on land.

Model the original antenna at VHF by considering a triangular loop with long lossy pyramidal core whose conductivity can be experimentally varied, over metal ground plane or salt water surface. Compare results with similar VHF model for a circular geometry and theoretical calculations to be made at both VHF and VLF for the circular geometry, thereby permitting estimation of radiation properties and efficiency of the original antenna.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0017, COORDINATED SCIENCE LABORATORY JSEP

R.T. Chien, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Coordinated Science Laboratory, *106 Engineering Hall, Urbana, Illinois* 61801 (DN975431; N00014-79-C-0424)

The objectives of this program are to provide new devices, techniques, and systems useful for a variety of Navy functions involving advanced concepts in information sciences and electronics. Each project undertaken by the laboratory under this program is of direct interest to the three sponsoring services and is subject to review by the Joint Services Electronics Program Technical Advisory Committee.

Support is provided for the University of Illinois, Coordinated Science Laboratory, to attack a broad spectrum of applied and basic problems including topics in information sciences, control theory, communication theory, semiconductor physics, molecular spectroscopy and properties of solid surfaces.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0018, STRUCTURAL RESPONSE ANALYSIS

J.M. Santiago, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0M4547)

The objectives are to enhance and augment existing structural response computer code capabilities in order to more realistically assess blast and fragment induced damage to complex engineering structures used by the Army (such as helicopter airframes, armored vehicle bodies, equipment shelters, reentry vehicles).

Effort will be made to acquire and implement on the BRL computer the most suitable finite element structural dynamics program capable of treating the nonlinear anelastic transient response of bulkheaded, stringered shell structures typical of airframe and armored vehicle construction. The initial phase of the effort would involve a literature search and evaluation of existing programs. After implementation of the program, suitable modifications to enhance treatment of new problems as encountered will be made. A subsidiary effort will be performed to enhance the strain predictions and boundary modeling capability of our in-house finite difference structural response program, REPSIL, and to modify the REPSIL/PETROS family of programs to treat cutouts and access openings by coding internal free edge boundaries.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0019, NOE HELICOPTER NAVIGATION ANALYSIS

N. Shupe, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DA0G2462; DAAK80-79-C-0268)

The objective of this program is the development of a terrain correlation navigational aid in the form of an extended Kalman filter algorithm which provides a continuous real-time update (accuracy improvement) of positional output from the AN/ASN-128 Doppler Navigation System. This enhancement of positional information is required as an essential component in an effectually integrated night navigation/pilotage system (NNPS) conforming to the stringent demands of low level nap-of-the-earth (NOE) flight.

This effort is comprised of 3 phases. Phase 1: identify performance characteristics of various equipments used in the Army's navigational suite. Develop models that represent error sources suitable for simulation studies. Phase 2: parametric performance analysis of proposed algorithm with emphasis on sensitivity to key parameters such as various terrain data base configurations. Phase 3: Evaluate the selected filter algorithm focus on methods of improving heading accuracy and operating mission performance over typical NOE terrain. The final filter design should be capable of accepting all available navigational instrument outputs and be optimized for maximum improvement of position, velocity, and heading.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

4.0020, AIRBORNE FERROGRAPH DEVELOPMENT

E.R. Bowen, Foxboro Transsonics Inc., *Burlington, Massachusetts* 01803 (DN796802; N00140-76-C-0713)

The principle objective is to develop and fabricate for evaluation engine mounted sensors to detect impending oil wetted parts failures in gas turbine engines. This contract will determine the best method of measuring the wear debris deposited by the magnetic precipitation technique. The candidate approaches are: resistive, inductive, capacitive and optical. The goal is to detect 95% of bearing or gear failures in sufficient time to avoid catastrophic failure or secondary damage. The technical effort is based on previous development contract numbers N00140-72-C-6082 and N00140-73-C-1065.

The initial eighteen months of this effort consists of final system design, with particular consideration given to reducing weight and size, and prototype fabrication and delivery. This prototype unit will be evaluated at NAPC to verify operating characteristics on a gas turbine engine. If the evaluation reveals a need for minor redesign, a three month redesign, reevaluation period is provided. Upon satisfactory completion of the evaluation, the Navy has the option to authorize go-ahead for fabrication of five additional units. Lack of funding presently precludes exercising this option.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0021, NONLINEAR INTERACTIONS BETWEEN LASER RADIATION AND SPIN ALIGNED CARRIERS IN SEMICONDUCTORS

E.J. Johnson, General Telephone & Electronics Corp., G T E Laboratories Inc, *40 Sylvan Rd., Waltham, Massachusetts* 02154 (DF052630; F49620-78-C-0082)

AF function - secure space communication and covert optical electronics require devices which exploit the properties and interaction effects of materials with infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - there are five principal objectives in this research on semiconducting compounds: 1) to better understand details of the spin dynamics of recombining electron-hole pairs, 2) to study the spin dependence of optical transitions near the fundamental absorption edge, 3) determine the gain and polarization properties of lasers in the presence of spin alignment, 4) study the effects of optical spin alignment on the output of laser amplifiers using polarized injection signals, 5) investigate techniques for fast switching of the polarization of infrared signals using spin-dependent phenomena. How work contributes - it is expected that this work will lead to a powerful technique for fundamental studies of semiconductors for fine probing of spin-dependent optical transitions, for studying spin dynamics in the formation of various band-edge complexes and for influencing stimulated emission processes. Optical spin alignment has far-reaching implications for the technology of semiconductor lasers as infrared sources and signal processing devices that are needed for optical communications.

The general approach will be to examine the intensity and analyze the polarization of emitted radiation in photoluminescent experiments under a variety of conditions. In simple preliminary optical spin alignment (OSA) experiments, a bulk sample will be used and the exciting radiation of arbitrary frequency will be circularly polarized. In experiments designed for detailed probing of the fundamental absorption edge, the high intensity tunable output of an infrared dye laser pumped with a cavity dumped krypton ion laser will be used as the source of exciting light. To study effects of spin alignment on stimulated emission, resonator structures are being developed for oscillator and amplifier applications. Using such resonators, the effect of polarized pumping and polarized injection signals on the intensity and polarization of the output emission will be studied. Techniques for fast switching of laser output will evolve from the study of OSA interactions in stimulated emission. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, MAGNETIC PHASE DEPENDENCE OF THE NICKEL-CO REACTION RATE

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046200; AFOSR-77-3130)

AF function - this proposed research falls in the 2.2 research objectives which deal with materials which are specifically designed or used for their environmental resistant qualities. Materials response to hostile environments in general are included excepting electronic materials. The mechanisms responsible for materials degradation in hostile environments must be studied to provide a basis for developing environmentally resistant materials and to be able to predict materials response and life time service. Deficiency - one needs to obtain fundamental thermochemical and thermophysical properties data on materials which chemically interact with oxygen. Recent improvements in fabrication and material processing techniques have led to the development of many materials which are stable in high temperature oxidizing environments. Objective - the objectives of this research program are to study the general question of the dependence of chemical reaction rates on the magnetic state of a transition metal catalyst. Contribution - this research is a part of a comprehensive program in statistical mechanics of real systems.

A research program is proposed to address the general question of the dependence of chemical reaction rates on the magnetic state of a transition metal catalyst. The PI's recent discovery of a large change in activation energy for the nickel car-

bonylation reaction (delta e ferro-delta e para) depending on whether the metallic substrate is ferromagnetic or paramagnetic (the Hedvall effect), has led to several new areas of investigation. Experimental studies are proposed to investigate in detail whether the activation energy changes discontinuously at the Curie temperature TC or whether there is an additional anomaly at TC in an arrhenius plot of in R vs 1/T, where R is the chemical reaction rate. They propose to investigate further whether the observed (delta e ferro-delta e para) is the same for other chemical reactions on nickel surfaces, depending only on the bulk exchange energy for the metallic substrate. They are also anxious to contrast the effect observed for the nickel carbonylation reaction on a ferromagnetic Ni surface with reactions on other ferromagnetic surface (e.g. CO) or antiferromagneitc surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, SPACE PROPULSION WITH BEAMED PULSED LASER ENERGY

A.N. Pirri, Physical Sciences Inc., *30 Commerce Way, Woburn, Massachusetts* 01801 (DN975142; N00014-78-C-0328)

The objectives of this study are to define potential missions for a pulsed laser propulsion system using a ground-based laser, and to determine thruster designs and laser requirements for efficient performance at visible/UV laser wavelengths. Such a system has potential application to advanced naval weaponry.

Systems analyses will be carried out for projected DOD missions and laser capabilities anticipated for the late 1980's. Plasma absorption physics for visible/UV radiation will be modeled analytically to determine wavelength scaling of energy conversion in the thruster. Results will be incorporated into an existing nozzle gasdynamics code to calculate optimum thruster designs. In a complementary experimental program, wavelength scaling of laser breakdown will be studied by irradiating candidate propellant gases with KRF/XEF and CO2 laser beams. Energy conversion efficiency in a nozzle will be measured using a single pulse externally focused KRF/XEF beam. Optimum nozzle configurations will be investigated for mission-related specific impulses, using a two-pulse sequence in which a CO2 laser forms the flowfield and a KRF/XEF laser generates the thrust.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0024, THERMAL STABILITY OF POWER TRANSISTORS

D.H. Navon, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG79-01819)

Characteristics of semiconductor power switching devices are being investigated with the aid of numerical models. Specific problems being considered include: 1. The operation of V-groove MOSFET (metal-oxide-semiconductor field-effect-transistor) structures under high current and high voltage conditions, taking temperature into account. 2. The operation of the V-MOSFET as a high current, high speed switch. 3. The limitations on power handling capability of V-MOSFET and V-groove junction FETs. 4. The power limitations of V-FETs in an inductive circuit environment. 5. Design criteria for optimum performance of the V-FET as a high frequency device.

This is a continuation of research previously supported under NSF grant ENG-7509334 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering

4.0025, INVESTIGATION OF THICK REFLECTION HOLOGRAMS

W. Colburn, Environmental Research Inst. of Michigan, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (DF052120; F49620-78-C-0061)

AF function - future Air Force weapons systems will require the real-time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. The most promising solution at the present time is the use of the parallel processing capability of optics. Opportunity - optical processors currently require complex lenses which are heavy, bulky, and expensive. The proposed effort will investigate holographic optical elements (HOES) which offer advantages of a reduction in the mechanical stability problems of conventional optical systems, a reduction in the number of optical elements, and a reduction in weight, size, and cost, all of which render these elements very applicable to the development of optical systems for aircraft and missiles. Objective - this research will formulate both a comprehensive exposure model of dichromated gelatin holograms and theoretical techniques capable of describing the behavior of practical thick holograms. How work contributes - this effort advances optical processors for airborne and terminal guidance applications.

Theoretical techniques will be formulated including important fringe parameters of thick reflection holograms. The thick hologram equations will be formulated by two different approaches - thin grating decomposition and differential coupled-wave and the results will be compared. Novel techniques for producing holograms with desirable fringe structures will be investigated, and specific holographic optical elements will be designed, fabricated, and evaluated to demonstrate the accuracy of the theoretical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, NAVY ENVIRONMENT - SOLAR REACTION STUDIES

A.D. Belmont, Control Data Corp., Research & Advanced Design Lab, *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DN875372; N00014-78-C-0306)

The objective of this research is to locate in time and space the atmospheric response to a solar event. It is known that solar events do affect planetary waves. If the effect is significant it has value for the long range forecast in support of strategic planning.

As in the first phase of this study radiosonde data from 0 to 30km was used to study patterns of amplitude and phase of the 27 day and the 11-year solar cycles in wind and temperature. There has now been accumulated twenty years of rocket data for the stratum of the atmosphere from 30 to 60km. These data will be studied along selected meridians in search for latitudinal effects as well as the longitudinal effects. These data will be supplemented by satellite data from which temperature information can be obtained from the measured radiances.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0027, DEVELOPMENT OF MICROCOMPUTER FOR PORTABLE VISIOCEILOMETER

G.E. Bingham, U.S. Dept. of Defense, Army, Corps of Engineers, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0F2145; W43P65 78-8027)

Fabricate and program a microcomputer assembly with readout and tape cassette recorder that will be capable of processing, indicating, and recording the transient signals from the visioceilometer.

Use high quality RCA 1802 microprocessor linked to Floating Point processor to simplify programming. Use erasable PROM's that are removable for ease in reprogramming. Assure recorded data is ASC-II formatted.

SUPPORTED BY U.S. Dept. of Defense, Army, Electronics Research & Development Command

4.0028, TERRAIN ANALYSIS FOR HELICOPTER OPERATIONS

L.E. Link, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0A8015)

To develop analytical procedures for evaluating terrain influences on helicopter survivability in flight and in the attack mode.

Computer programs will be written to model helicopter dynamics, the pilot, and the associated weapons systems. The object of the modeling effort will be to determine the survivabi-

lity of a helicopter while accomplishing its assigned mission. Models will provide the capabilities for comparing and evaluating: (a) flight paths and altitudes with least exposure to a specific ground-based weapon system, and (b) evasive maneuvers as to the time a helicopter remains within the weapon coverage region after the helicopter is brought under fire (helicopter maneuver capability included).

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

4.0029, DEVELOPMENT OF IMPROVED FATIGUE LIFE TRACKING SYSTEMS FOR NAVY AIRCRAFT

R.E. Pinckert, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN081258; N62269-79-C-0225)

To develop improved fatigue life tracking systems for Navy aircraft in order to achieve significant improvements in the accuracy of fatigue-life-expended estimates of fleet aircraft. This contract will support Work Unit ZA-601, Aircraft Technology, Agency Accession DN 681080.

Program will be done in two phases. Phase 1 will be a conceptual design, analytical assessment and cost optimization of candiate tracking systems. Phase 2 will be a flight test and laboratory evaluation of the function and accuracy of the improved systems.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0030, INFLUENCE OF WALL ROUGHNESS ON THE CORE FLOW IN A SUPERSONIC MHD GENERATOR

P. Lu, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Mechanical Engineering, *Lincoln, Nebraska* 68508 (DF054810; AFOSR-79-0083)

AF function - weapon delivery and defense, advanced MHD electric power generators and electric lasers. Deficiency - insufficient in-depth understanding of the properties and behavior of flowing phasing and the influence of wall roughness on the core flow and associated pressure increase in supersonic MHD electric power generators. Objective - to better understand the propagation of disturbances along Mach and/or shock waves due to wall roughness and their interactions with the turbulent boundary layer and their influence on the core flow through a supersonic (high-power-density) MHD generator and the possible associated pressure increase, and to develop theoretical and mathematical models describing the interaction and pressure increase phenomena. How work contributes - will provide additional understanding and analytical modeling of the Mach/shock wave-turbulent boundary layer interaction and pressure increase phenomena, in actual MHD generators, will aid in control or reduction of these effects, and will contribute to the technology base required for development of more efficient MHD electric power generators.

An analytical study will be made of the influence of wall roughness on the core flow through a supersonic (high-power-density) MHD electric power generator and the possible associated pressure rise with flow direction. Crocco's theory will be generalized to treat MHD pseudo-shocks as well as wave interaction due to an isolated electrode, in supersonic and high magnetic-field strength generator channels. Crocco's control-volume analysis will be enlarged to incorporate all the MHD aspects including load and hall effects. The analytical model will be used to explain qualitatively modification of the core flow due to shock and Mach wave interactions with the turbulent boundary layer near the wall as well as the observed pressure rise in the flow direction downstream observed in actual MHD generators. Theoretical results will be compared with those obtained in practical cases at AFAPL. Recommendations will be made of the desirability of continuing future investigations in MHD power generators along the same line of approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, STUDIES OF SLENDER, AXIALLY SYMMETRIC BODIES AT INCIDENCE AT HIGH REYNOLDS NUMBERS (14254-E)

S.M. Bogdonoff, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (DA0F9113; DAAG29-77-G-0234)

To experimentally investigate the flow field about two axisymmetric configurations, a tangent ogive-cylinder and a secant ogive-cylinder, at low incidence using a high Reynolds number supersonic wind tunnel. Relevance: Experimentally obtained data for three dimensional turbulent boundary layers on axisymmetric bodies at incidence is urgently needed for verification of recent theoretical developments at BRL. Such data would be quite useful in validating theories for design of Army missiles and projectiles.

Both surface and flow field measurements will first be made on a tangent ogive-cylinder model at Mach 3 and a Reynolds number of approximately 1.6 million per inch, at incidence angles of 2 degrees and 4 degrees. Measurements will be made at 30 degree increments of azimuth angle at 4, 5, and 6 diameters from the model tip and similar measurements will then be made for a second nose geometry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, HIGH-TEMPERATURE CATALYTICALLY ASSISTED COMBUSTION

F.V. Bracco, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF044300; AFOSR-76-3052)

AF function - weapons delivery and defense, transport, advanced air-breathing engines. Deficiency - insufficient understanding of the basic physical, chemical and fluid dynamic processes of ignition, stability, and efficiency of catalytic combustion. Lack of guidelines for predicting catalytic combustor performance and for solution of existing combustor difficulties. Objective - to clarify the relative importance and to formulate realistic analytical representation of homogeneous, heterogeneous kinetics and transport processes in catalytic combustion phenomena associated with advanced air-breathing combustion systems. How work contributes - will provide additional understanding and needed realistic analytical modeling of homogeneous and heterogenous high temperature catalytic combustion processes not now available. Will contribute to establishing realistic guidelines and techniques for the design of efficient, stable, jet engine catalytic combustors.

Theoretical and experimental studies will be made of basic fluid dynamic, physical and chemical processes in catalytic combustion associated with air-breathing propulsion systems. The relative importance of gas phase kinetics, heat transfer, mass diffusion, and surface chemical kinetics will be assessed. The practical phenomena will be experimentally simulated. Deficiencies in existing mathematical models will be demonstrated and improved models formulated based on experimental data and field observations. Various monolithic and packed-bed catalyst candidates for advanced combustor design will be studied over a range of operating conditions characteristic of advanced air-breathing propulsion engines with various hydrocarbon fuels. A two-dimensional time-dependent model of the physico-chemical processes taking place inside a typical catalytic channel will be formulated capable of predicting start-up procedures, ignition and steady-state operation of the catalyst in both laminar and turbulent regimes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, RELAXATION PHENOMENA IN OPTICALLY-PUMPED MERCURY ISOTOPES

P.A. Heimann, Singer Co., *1150 McBride Ave., Little Falls, New Jersey* 07424 (DF035170; F49620-76-C-0009)

AF function - this research is being supported in response to RN-AFAL-05-72-1, nuclear magnetic resonance gyro improvements. Deficiency -the magnetic resonance gyro has considerable potential for Air Force applications. Objective - research is directed toward determining the nature and range of

magnetic interactions and the factors which can change the nature and range. Contribution - the magnetic resonance gyro will be ideal for strapdown systems having an extremely high dynamic range, high g capabilities and small size. Possible users are aircraft and missile weapons systems.

This research involves an experimental and theoretical investigation of the sources of noise and drift in an NMR controlled oscillator and an experimental investigation of the fundamental interactions between population distribution over the magnetic sublevels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0034, HYDROGEN PUMPED IODINE LASER

J.A. Blauer, Bell Aerospace Textron, *P.O. Box 1, Wheatfield, Buffalo, New York* 14240 (DF187160; F29601-76-C-0063)

The objective of this work is to develop a high energy, chemically pumped, electronic transition laser. Detailed studies of the H and HI reaction will be used to investigate energy transfer from vibrationally excited hydrogen molecules to iodine atoms and to demonstrate lasing by electronically excited iodine atoms at 1.315 microns.

Atomic hydrogen will be generated by shock heating mixtures of H(2) and Ar to 4500K. The hydrogen atoms will be expanded out of the shock tube through a nozzle where HI will be injected into the flow. Optimum cavity conditions will be sought to demonstrate lasing. Other techniques to generate sufficient flows of hydrogen atoms will be pursued. Other energy transfer systems will be evaluated as to their potential for high energy, chemically pumped, electronic transition lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0035, TRANSONIC BLADE-VORTEX INTERACTION NOISE AND UNSTEADY WAKE FLOW (17425-E)

A.R. George, Cornell University, Ithaca Campus, School of Engineering, Dept. of Aerospace Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G3415; DAAG29-80-K-0065)

To develop simplified analysis techniques for understanding the principal features of noise radiation from the interaction of a transonic rotor tip with a vortex shed from a previous blade passage. Relevance: Blade-vortex interaction noise is a large source of noise on many operational helicopters within the Army and this research is directly relevant to control and minimization of such noise sources.

Perturbations of wake geometry due to turbulence efforts will be carried out to predict changes in vortex geometry and the transonic flow will be analyzed by a high reduced frequency linearization about the steady transonic flow. Resulting outgoing sound waves will be modeled by either classical techniques, geometrical acoustics or Kirchoff type formulation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0036, FINITE-ELEMENT TECHNIQUES FOR AERODYNAMIC COMPUTATIONS OF COMPLEX CONFIGURATIONS

S.F. Shen, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, *Ithaca, New York* 14850 (DN223121; N00014-75-C-0375)

The development of accurate and rapid methods for the prediction of the flows about complex configurations is essential for the design and optimization of naval aircraft and missiles. This task will provide for a systematic study of finite-element methods as applied to such flows.

The computation of the flows about complex configurations in aeronautics now tax, and will continue to tax for the foreseeable future, the capabilities of the most advanced computing machines. Hence there is a continuing need to explore and develop new and more efficient methodologies for complicated flows. The major numerical method to date has centered about finite difference approximations to the governing partial differential equations. Alternate procedures are being developed based on finite-element approximations; approximations which appear to be more practical for complex geometries. These finite-element methods may or may not employ variational principles. This research will systematically examine various aspects of the finite-element method. Initially, inviscid incompressible flow will be studied, utilizing a variational principle, with emphasis on the body geometry. These results will be assessed against exact solutions. The major emphasis will be devoted to a study of inviscid compressible aerodynamic problems including transonic flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0037, BASIC TECHNOLOGY OF SQUEEZE-FILM DAMPERS FOR ROTOR-DYNAMICS CONTROL (15657-E)

C.H. Pan, Shaker Research Corp., *Northway 10 Executive Pk., Ballston Lake, New York* 12019 (DA0F9245; DAAG29-78-C-0027)

To study and analyze the squeeze-film damper as a means of stabilizing rotor shafts and reducing vibration and shock excitation. Relevance: Dampers of the type studied are needed to control vibration of rotors.

To perform an analytic formulation and solution of the system, including cavitation; and verify the solution experimentally.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, DEVICE HARDENING

W.M. Shedd, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903660)

The objective of this effort is to maximize the tolerance of semiconductor devices and integrated circuits to the radiation from both nuclear explosions and the natural space environment. This will be accomplished by maximizing the radiation resistance of devices and integrated circuits through the use of improved materials and processing techniques, new device designs, and hardened circuit design techniques. This effort is intended to provide the integrated circuit design and fabrication techniques for radiation hardened electronics.

A radiation hardened CCD signal processor will be developed to demonstrate the ability of CCD devices to perform in a radiation environment up to the limits of available MOS technology. A program to develop an improved dielectric isolation technology for radiation hardened circuits will begin. Techniques will be developed for improving the area over which tightly controlled thickness for device pockets can be maintained. A study will be performed to determine the most promising technology for radiation hardened microprocessors. SMOS/SOS technology will be improved to obtain radiation hardened LSI. Further work will be done to improve SOS technology to reduce back channel leakage currents, improve gate protection circuitry, and increase device yields.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0039, SHIP INDUCED WIND TURBULENCE

T.S. Garnett, Boeing Co., Boeing Vertol Company, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN096146)

Investigate the three-dimensional flow pattern in the immediate vicinity of a DD963 class flight deck using static and dynamic model tests.

Conduct the following tests and investigations; (1) smoke tests to obtain visual observations of the flow pattern; (2) static wind tunnel tests will determine three-dimensional velocities in a column encompassing the flight platform and extending 50 feet above and to the side of the platform; (3) dynamic wind tunnel tests to provide real time motion inputs to the ship's base to determine disturbances generated by it's oscillating superstructure; (4) 'math' modeling to characterize the turbulence in stochastic terms as random variables.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Engineering Center

4.0040, A COMPUTER MODEL OF SACCADIC SUPPRESSION

W.J. Ohley, University of Rhode Island, School of Engineering, Dept. of Electrical Engineering, *Administration Bldg., Kingston, Rhode Island* 02881 (DF057840; AFOSR-80-0112)

AF function - given the increasing price of fuel, the Air Force will be depending more and more on simulated flight trainers to prepare and maintain aircrew combat readiness. The proposed research will contribute information about human visual processing that can be used to more effectively and efficiently generate appropriate visual displays for these flight trainers. Deficiency - visual displays for flight trainers are, at present, inadequate representations of the depth and motion cues necessary for adequate flight training. This inadequacy is due to constraints imposed by realtime generation of the displays. Saccadic suppression is a phenomenon of the human visual system through which visual sensitivity is reduced during fast (saccadic) eye movements. It has been suggested that display generation be coupled with pilot eye movements thereby taking advantage of saccadic suppression to overcome limitations in display quality imposed by time constraints. However, not enough is known about the conditions under which saccadic suppression occurs outside of the laboratory. Objective - Dr. Ohley proposes to develop a model of saccadic suppression and to use it to predict human performance under conditions that are extremely difficult to test empirically. How research contributes - saccadic suppression is a phenomenon that has been investigated by a number of investigators with a variety of experimental techniques and consequent variety of experimental results. The model suggested in this research proposal has the capability of integrating information from these sources into a single entity. This integration would be a significant contribution to the field of vision in general and would directly contribute to the research at Wright-Patterson concerned with display generation.

To refine, by interative validity testing, a previously developed model of saccadic suppression so that its output is consistent with available experimental data. Then the model will be used to predict the effects of eye acceleration, non-homogeneous retinal spatial properties and various visual stimuli on saccadic suppression.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, FREESTREAM AERODYNAMICS

H. Kaupp, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF641560)

Air Force function - aircraft-stores compatibility. Opportunity -structural integrity and certification of stores on aircraft. Goal - to provide store-free stream aerodynamic data in graphical, tabular, and magnetic tape form. How work contributes - allows for a quick and efficient means of obtaining data for use with MIL-A-8591E and for comparisons with stores in carriage.

The approach will be to first compile the existing available store-free stream aerodynamic data, and then develop a data retrieval system which allows for access to the data through tabular, graphical, or magnetic tape form. The system will be updated to include new data as it becomes available.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0042, SPECIMEN HOLDER AND CONTROL SYSTEM FOR NEUTRON SMALL-ANGLE SCATTERING STUDIES

R.W. Hendricks, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (DMR77-24458)

This award is for partial funding of the design and construction of a specimen holder and control system that will permit dynamic x-ray and neutron small-angle scattering studies of polymer samples undergoing deformation, relaxation, or crystallization. The device will provide a controlled environment with respect to the atmosphere and the temperature, and allow preloading of the specimen to a fixed elongation followed by an oscillating load. Alternatively, it will be possible to carry out a single high-speed elongation of the specimen in about 10 msec.

The remainder of the funding will come from the Office of Basic Energy Sciences of the Department of Energy. On completion, the device will be part of the Natonal Center for Small-Angle Scattering Research at Oak Ridge National Laboratory. Personnel from the University of Massachusetts at Amherst will assist in the construction.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0043, EXTENDED APPLICABILITY OF OPTICAL WIND SENSING TECHNIQUES (16654-GS)

J. Smith, University of Texas, El Paso Campus, School of Engineering, Dept. of Electrical Engineering, *El Paso, Texas* 79999 (DA0G9071; DAAG29-79-C-0072)

The objective of the research is to extend the applicability of optical wind sensing techniques utilizing lasers to conditions of high humidity, mist and rain. Under these conditions temperature variations are reduced and the signals observed from these variations are not suitable for the determination of the horizontal wind. Relevance: The work has immediate relevance to the Atmospheric Sciences Laboratory Wind Sensing Program.

The research will involve field work in a region where high humidity, mist and rain can be expected often. It also will involve testing temporal filtering techniques to extend the capability to recover horizontal wind speeds. A third approach will be the use of infrared and millimeter wave generating devices to determine horizontal winds utilizing refractory changes dependent on water vapor motion.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0044, INVESTIGATION OF WEIGHT PENALTY FOR PNEUMATIC FLUIDIC BACK-UP FLIGHT CONTROLS

G.K. Fling, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN890302; N00019-80-C-0291)

The technical objective is to investigate and determine the weight penalty of a fluidic back-up flight control system compared to other candidate back-up control systems.

The contractor will conduct a technical investigation of the weight penalty, if any, for the back-up flight control system proposed for the V/STOL 'B' aircraft. This investigation will compare several candidate systems, their components and their configuration. A determination will be made and recommendations for a back-up system will be presented.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0045, DYNAMIC FRACTURE FUNDAMENTALS IN PARTICULATE COMPOSITES UNDER COMPRESSION

S. Swanson, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Mechanical & Industrial Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DN075062; N00014-80-C-0156)

The objective is to investigate the nature of the dynamic crack propagation process in viscoelastic analogues of solid propellants and plastic bonded explosives under pressure. The research will provide an understanding of how the material properties and internal geometry of a particulate composite material affect its ability to resist crack branching, fragmentation and the creation of new surface area available for convective combustion.

The effect of pressure on the dynamic crack propagation behavior will be determined. Hydrostatically compressed samples of particle filled and unfilled polyurethane elastomer will be fractured in tension. crack propagation velocities will be measured at pressures up to 3 x 10 to the 8 power n/sq m.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0046, THREE-DIMENSIONAL DISTURBANCES IN HIGH SPEED BOUNDARY LAYER FLOWS

G.R. Inger, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (DF045690; F49620-76-C-0013)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure and mechanisms of flow separation/reattachment with their attendant three-dimensional effects on pressure distribution, skin friction and heat transfer phenomena. Objective - investigate the twin problems of flow separation/reattachment and three-dimensional effects in high speed boundary layer flows along two-dimensional and axisymmetric bodies. How work contributes - better understanding of this phenomena will be directly applicable to the design of future aerospace vehicles.

A theoretical study will be established with the objective of developing a fundamentally sound yet engineering-oriented analytical approach from which skin friction, heat transfer, and wave drag can be predicted as function of Mach and Reynolds numbers, wall temperature ratio and vortex parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, LAMINAR SEPARATION AND FLOW INSTABILITIES

A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Mechanics, *Blacksburg, Virginia* 24061 (DN223402; N00014-75-C-0381)

The ability to predict and to control flow instabilities and separation is essential for the design and optimization of aircraft and missiles. The proposed research will study, theoretically, confined separation bubbles on compression ramps at supersonic speeds, and the generation of secondary instabilities in laminar boundary layers.

A study will be made of confined separation bubbles formed on compression ramps at supersonic speeds in an attempt to extend the range of validity of the classical triple-deck asymptotic model to lower Reynolds numbers. The analysis will be in a theoretical framework which extends the classical model to second order and concentrates on the case of non-adiabatic walls. The new results will be compared with the first order predictions and with predictions of interacting boundary layer theory to assess the breakdown of the triple deck concept as the Reynolds number is reduced. In addition, secondary instabilities in laminar boundary layers will be investigated. The Tollmien-Schlichting instability wave will be calculated for a blasius flow and combined with the blasius flow. The resulting combined flow will be linearly perturbed and the conditions for the initiation of secondary instabilities, both two- and three-dimensional, will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0048, BOUNDARY LAYER TRANSITION ON BLUNT BODIES

C. Merkle, Flow Industries Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DF038560; F44620-74-C-0049)

Blunt reentry heat shields sometimes experience unprogrammed ablative shape changes on account of unpredicted boundary layer transition. In severe cases the resulting aerodynamic disturbances can cause a malfunction of internal components. This effort will apply nonlinear stability theory concepts in an analytical attempt to get a more fundamental understanding of boundary layer transition from laminar to turbulent flow in the very complex environment of blunt reentry nose shapes. Compressibility, roughness, surface mass injection, entropy swallowing as well as the offsets of surface curvature will be included in the analysis. The current year will emphasize the simultaneous effect of these various influences on stability, as opposed to their independent individual influences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, INLET FLOW DISTORTION IN A SINGLE STAGE AXIAL FLOW COMPRESSOR

J. Breugelmans, Von Karman Inst. for Fluid Dynamics, *Rhode St. Genese, Belgium* (DF702710; AFOSR-80-0119)

AF function - research in fluid mechanics of rotating turbomachinery. Deficiency - inlet flow distortions are commonly encountered in the operation of jet engines. Better methods are required for the prediction of off-design performance and the effects of rotating stalls and surges. Research - this research aims at a better understanding of the basic phenomena associated with inlet flow distortions. How research contributes - by means of very careful measurements in a simple one-stage system, it is planned to provide reliable data for comparison with current models.

A 'cold-hot' wire arrangement will detect the onset of separation while instrumentation in the absolute frame defines the actual operating conditions of the compressor stage. The VKI single-stage compressor R-1 will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

4.0050, IMPROVED ICING SEVERITY LEVEL SYSTEM

P.L. Corley Byrne, Leigh Instruments Ltd., Avionics Division, *Toronto, Ontario, Canada* (DA0G0497; DAAK51-79-C-0061)

The objective of this contract is to develop a readily understandable display of the effects of flight through natural icing conditions for use by operational Army helicopter flight crews.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

4.0051, ATMOSPHERIC ASPECTS OF EMPLOYMENT OF CO2 LASER

P. Browne, University of Manchester, University of Manchester Inst. of Science & Technology, *Sackville St. 1 Lancs, P.O. Box 88, Manchester, England, United Kingdom* (DA0D9330; DAERO 78 G0126)

To determine the effects of atmospheric clouds, fogs, and mists on the propagation of coherent electromagnetic radiation with a wavelength of 10.4 micrometer, with special attention to linear attenuation and backscattering, non-linear attenuation and backscatter, and beam quality under both linear and non-linear propagation conditions for clouds produced in the laboratory by adiabatic expansion.

Greatly-improved versions of a high-energy pulsed CO2 laser, and a low-power continuous-emission CO2 laser will be developed, so that they can be used both in the laboratory and the field. Laboratory experiments will be based on measuring transmission and scattering characteristics of the beams while propagating through water aerosol clouds generated by adiabatic expansion of saturated air in a chamber under controlled conditions. Field experiments will be conducted in natural water aerosols at Great Dun Fell. Close coordination will be maintained with the Atmospheric Sciencies Laboratory and with other Army laboratories.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0052, COHERENT STRUCTURES IN TURBULENT FLAMES BY LASER ANEMOMETRY

N. Chigier, University of Sheffield, *Mappin St., Sheffield, England, United Kingdom* (DF049690; AFOSR-77-3414)

AF function - advanced diagnostic techniques, advanced airbreathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day intrusive measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using laser Doppler anemometry (LDA) for obtaining high spacial and time resolution particle size and velocity

measurements in practical combustion environments, to determine capabilities and limitations of LDA as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytic models of complex reacting flows, will help reduce development time and cost of airbreathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ non-disturbing techniques for accurately measuring turbulent reacting flow parameters.

This study encompasses detection and measurements of coherent structures in turbulent gaseous and liquid fueled diffusion flames by sophisticated noninterference techniques (e.g., laser anemometry, high speed photography, color schlieren) and fine wire thermocouples and flame ionization probes. Information on variation of velocity with both time and space will be obtained from a high-frequency response laser anemometer, powered by an argon ion laser and single particle counter, interfaced with a high-speed computer. Gas concentration measurements will be made by mass spectroscopy and gas phase chromatography. Growth and movement of coherent structures will be studied by high-speed move-photography and color schlieren and related to direct measurement of velocity and temperature. Detailed physical mechanisms of fuel-air mixing across interfaces will be studied and related to presence of large eddies and coherent structures in the turbulent flow field. The effect of impingement of a turbulent jet flame on a cold flat plate will be studied. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, AURORAL HIGH LATITUDE MORPHOLOGY AND DYNAMICS

S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *C.T. Elvry Bldg., Fairbanks, Alaska* 99701 (DF582490; F19628-79-C-0067)

AF function - transpolar communications, radar and navigation. Deficiency - the polar ionosphere is presently very unpredictable to such a degree that the above functions are frequently degraded or crippled. Objective - investigate the phenomenology of the Arctic ionosphere to provide a capability for the prediction of the onset and intensity of ionospheric substorms. How research contributes - provides for the interpretation of data in terms of magnetospheric phenomenology and theory as a basis for the prediction of the onset and severity of magnetospheric substorms and warning of disturbances in support of AF systems. This effort provides inputs to in-house research for modelling effects of particle precipitation on Arctic ionosphere. Investigates the phenomenology of Arctic precipitation through the collection and analysis of data to provide a framework for the interpretation of data collected by AFGL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131 and the AFGL Goose Bay Ionospheric Observatory.

Process and maintain aircraft and ground station all-sky camera data. Gather and interpret ionospheric and magnetospheric data for selected periods in support of special studies. Investigate ionospheric response during a magnetospheric substorm. Clarify relationship between discrete and continuous aurora using DMSP data. Study the interaction of the interplanetary magnetic field with the geomagnetic field in relation to magnetospheric substorms. Evaluate and develop techniques for predicting magnetospheric substorms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, STUDY OF MAGNETOSPHERIC SUBSTORMS

S.S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *C.T. Elvry Bldg., Fairbanks, Alaska* 99701 (ATM77-26522)

This grant was preceded by a project entitled 'A Study of Magnetospheric Substorms,' which was supported by the National Science Foundation through Grant ATM74-23832. This substorm study group, in cooperation with a number of other substorm study groups, made significant progress in understanding magnetospheric substorm processes, in particular the relationship between interplanetary magnetic field changes and substorms and the intensity of substorms as a function of the magnetic flux in the magnetotail. Further, they report no conclusive evidence of the information of the magnetic neutral line in the near-earth plasma sheet. Eight new problems are pointed out for further study; they are vital in finding missing links among substorm processes which we have already found and also new clues in unfolding the triggering process of substorms. Among them are the nature of magnetic field changes in the magnetotail, effects of the propagation of a rarefaction wave in the magnetotail, the identification of the boundary of the diffuse and discrete auroral belts in the equatorial plane and a theoretical study of a mechanism for current interruption on a collisionless plasma. The major aim of this study at the Geophysical Institute is to search for the cause of the magnetospheric substorm. As much, this work is pertinent to the aim of the International Magnetospheric Study.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0003, EXPERIMENTAL AND THEORETICAL RESEARCH ON THE AURORA BOREALIS

M.H. Rees, University of Alaska, Fairbanks Campus, Geophysical Inst., *C.T. Elvry Bldg., Fairbanks, Alaska* 99701 (ATM76-17409 A01)

This grant funds a theoretical and experimental study of the aurora. The experimental portion will make use of the new optical facility developed at the Geophysical Institute of the University of Alaska, while the major modeling computations will be carried out using the NCAR facility. The research uses an integrated approach, combining modeling and observations, in the following principal areas: 1. Helium emission in twilight and sunlit aurora. 2. N2 ion 1NG bands in twilight and sunlit aurora. 3. The O ion 3719 A emission. 4. Metastable nitrogen atoms in auroral chemistry. 5. Ion composition in aurora. 6. O2 concentration at high latitude by 6300 A twilight measurements. 7. Time-dependent studies of the aurora.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0004, THERMAL STUDIES OF MARS

H.H. Kieffer, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02458)

Detailed study of the reflective and emissive properties of the Martian south polar region. Determination of the Martian north polar winter behavior. Compilation of all available Viking thermal observations into a compressed data set at which is a statistically valid representation of the planet. Determination of the general correlation between Martian spectral reflectance, albedo, thermal properties, and surface topography and morphology.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, EOLIAN PROCESSES

J.F. McCauley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02353)

STATES TO WHICH PROJECT PERTAINS: Arizona, New Mexico.

Plans include continued wind tunnel experiments, field observations and electron microscopy studies to determine the response of various lithologies to wind erosion and to define the relative role of deflation as opposed to abrasion in the evolution

of planetary surfaces. Results of the studies in the Western Desert of Egypt will be reported as several chapters in a book to be published as a NASA Technical Memorandum. Systematic measurement of wind and other climatic data in various types of desert regions, obtained in connection with another project, is expected to result in mathematical models of eolian processes for application to the interpretation of data from planetary missions such as Viking and Voyager.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, INTERNAL FRICTION AND MODULUS MEASUREMENTS IN LUNAR ROCKS

B.R. Tittmann, Rockwell International Corp., *1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (EAR79-06709 A02)

This project will complete the characterization of the elastic and anelastic (Q) properties of lunar rocks 70215.85 taking maximum advantage of techniques developed under a previous grant to measure its attenuation and velocity under in-situ conditions and at seismic frequencies. One set of studies directed at the problem of extrapolating laboratory data obtained at ultrasonic frequencies to seismic frequencies will examine the frequency dependence of Q from 10 to the 5th power to 10 Hz. Another set of studies directed at variations with depth will examine Q and velocity with independent control of temperature and pressure, including variations of P and T along proposed lunar selenotherms. Some of these data will be employed to test the predictions of proposed attenuation mechanisms. These will be the first such measurements on a lunar rock which is unique and distinct from the terrestrial analogs studied thus far because of the absence of hydrated phases and fluid inclusions which have been shown to have a pronounced influence on Q and velocity. The anelastic and elastic properties of the lunar rock will shed light on the seismic Q and velocity profiles in the mare basalt regions of the upper crust. The work is based on an expanded data set and are finding important differences with previous interpretations and conclusions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0007, LIDAR TECHNIQUES FOR EVALUATION OF AEROSOL, CLOUD AND PRECIPITATION OPTICAL AND PHYSICAL DENSITIES (13833-GS)

E.E. Uthe, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0E9274; DAAG29 77 C 0001)

Develop and evaluate quantitative techniques for deriving from lidar backscatter signals, atmospheric optical and physical density parameters relating to aerosol, cloud and precipitation distribution. Relevance: The work addresses atmospheric transmission capabilities in the infrared frequency of military interest such as terminal homing and target acquisition devices and laser target designators. It is also important for development of remote ceiling and visibility sensors, chemical agent detectors, pollution monitoring at military arsenals and depots, and development of aerosols to be disseminated for screening purposes.

Reconfigure the wavelength and polarization of the mobile SRI lidar system to increase the capabilities of the lidar for quantitatively specifying atmospheric optical and physical density parameters relating to aerosols, cloud and precipitation distribution in the mesoscale. Develop and evaluate algorithms and processing signature data in terms of absolute atmospheric optical and physical density information accounting for atmospheric attenuation and scattering effects, and size and shape characteristics of the scattering particles. Evaluate experimentally, via two field programs, the accuracy and limitations of the techniques developed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0008, MONTE CARLO CURRENT COLLECTION CALCULATIONS

S. Takashi, Thompson Ramo Wooldridge Inc., *1 Space Park, Redondo Beach, California* 90278 (DF242300; F19628-74-C-0128)

AF function - nuclear weapons delivery, communications, detection, track and intercept. Deficiency - lack of knowledge of ionic distributions in the atmosphere hinders construction of models for nuclear blackout conditions. Research - perform Monte Carlo flow field calculations in the transition regime, as applied to the collection of ions by rocket-borne mass spectrometers. How research contributes - a good portion of the measurements we currently make falls within the transition regime, and since both free molecular flow and continuum theories are here invalid, the Monte Carlo method is needed to describe the process of ion collection. The ultimate objective of these calculations is to aid interpretation of flight results by finding the relationship between ion fluxes to the mass spectrometer and the corresponding ambient ion number densities.

Work includes analysis and interpretation of seismic data (both surface waves and static strain changes) as well as theoretical calculations of seismic sources in prestressed media and realistic source models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, ADVANCED GEOPOTENTIAL

A.K. Cooper, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9460-01660)

STATES TO WHICH PROJECT PERTAINS: Alaska, California, Washington, Oregon and Hawaii.

To provide 'state of the art' technical support in the processing and interpretation of marine geopotential (e.g. gravity, magnetics) and sonobuoy data. Techniques developed to provide this support will be applied to data collected by the Office of Marine Geology, particularly offshore Alaska. Specfically, these techniques will be used to determine the physical attributes of marine sedimentary basins and will include: 1. methods for reducing and analyzing high resolution and deep penetration sonobuoy seismic studies, 2. methods for modeling gravity and magnetic profiles over marine structures, and 3. methods for locating shallow and deep magnetic boundaries using analytic signal methods. Interactive computer techniques will be designed for an interactive graphics display minicomputer (Tektronix 4051) and the U.S.G.S. Honeywell 68/80 Multics system. Much of the project time will be spent in assisting other professional staff members on the use of the interpretative computer techniques and in preparing reports on scientific results from the interpretation of geopotential and sonobuoy data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, LUNAR CHRONOLOGY

D.E. Wilhelms, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (0-9580-01575)

Rank individual mare units in order of relative age and determine the history and relation to basin structures of color units in each age category. Report the results in the form of a colored geologic map.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, NAVY ENVIRONMENT - SATELLITE APPLICATIONS AND MARITIME WEATHER SYSTEMS

E.E. Hindman, Colorado State University, School of Science, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (DN075247; N00014-80-G-0042)

The objective of this workshop is to compare, under controlled working conditions, the range in variations of various techniques for measuring the light-absorption properties of aerosol particles; to define error limits to these techniques, and to assist in planning future research.

Measurements will be made on laboratory generated aerosols having defined physical and optical characteristics and

which approximate those found in nature. These measurements will be made with a variety of instrumentation simultaneously.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0012, NAVY ENVIRONMENT - SATELLITE APPLICATIONS AND MARITIME WEATHER SYSTEMS

T.H. Vonder Haar, Colorado State University, School of Science, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (DN075444; N00014-79-C-0793)

This proposal has four related objectives. There is work on maritime aerosols observations from satellites with some simultaneous multisensor (including surface) data interpretation. The second objective deals with cloud microphysics with emphasis on radiance. The third objective addresses pre-cloud (fog) air mass characteristics as observed by satellites. An overall objective is to advance the interactive use of satellite information and modeling of the marine atmosphere.

The contractor is using satellite data to analyze pre-cloud (fog) maritime aerosols. Interactive satellite information is being exploited for observing the marine atmosphere to improve prediction of maritime weather systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0013, RESEARCH AND DEVELOPMENT IN INSTRUMENTATION FOR GEOCHEMICAL EXPLORATION

R.C. Bigelow, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Exploration Research, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9330-00101)

STATE TO WHICH PROJECT PERTAINS: Colorado.

The measurements of gases that emanate from some geologic structures, such as buried ore deposits, may help our understanding of the dynamics of interaction in these structures. In particular, when gas measurements are correlated with other geochemical and geophysical data, they may provide evidence of on-going chemical activity in oxidizing and reducing zones, electrochemical activity in and around ore deposits, and interaction of emitted volatiles with overburden. Where gas emission can be correlated with surface samples, remote sensing of gases may provide more detailed coverage of a target area than is practical with surface sampling alone. Where there are no surface indications of buried active structures, gas measurements might provide a geochemical clue to their existence.

Thus the principal objectives of this project are: 1. To design and develop new instrumentation and to modify existing instruments to measure geochemically relevant gases. 2. To develop, for this and other projects, data handling systems and methods to acquire, interface and process geochemical data. 3. To provide assistance, as needed by other projects, in the design, development, maintenance, and repair of their instruments and to advise them, when requested, on the technological aspects of their instrumentation.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0014, GEOPHYSICAL STUDIES OF INDIAN LANDS IN WISCONSIN

B.D. Smith, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-02186)

STATE TO WHICH PROJECT PERTAINS: Wisconsin.

Ground geophysical surveys will be continued, in order to follow-up airborne geophysical surveys that define favorable areas for base metal mineralization. Advanced electrical and electromagnetic methods will be used to refine geophysical models for areas favorable for base metal mineralization. In addition, bore-hole geophysical methods will be applied to characterize the geologic section and, potentially, define favorable areas adjacent to the drill holes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0015, THERMAL MODELING INVESTIGATIONS

K. Watson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-01703)

To develop new and/or improved techniques for analyzing thermal infrared data and, thus, to extract the geologic information from thermal scenes. Such information includes rock-type discrimination, alteration effects, structures (folds and fractures), soil-type discrimination, vegetation stress effects, and near-surface heating. To accomplish these objectives, new computer algorithms will be developed to incorporate site-specific parameters, to minimize the topographic effects, and to more efficiently register day and night images. These algorithms will be tested using HCMM satellite and USGS aircraft thermal data and ground station data of the Powder River Basin, Wyoming. Other objectives are to complete the conversion of the airborne scanner to a digital system, to conduct airborne tests and acquire data of Walker Lake, Nevada and Ajo, and to do the preliminary planning for a laboratory system in which to measure thermal inertia of rocks and soils.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0016, SATELLITE MEETING ON STATISTICAL CLIMATOLOGY

F.C. Leone, American Statistical Assn., *806 15th St. N.W., Washington, District of Columbia* 20005 (DN975679; N00014-79-G-0059)

Knowledge of weather and climatological conditions and the ability to forecast play an important role in naval and marine operations. The use of statistical approaches to weather prediction is relatively undeveloped. This conference will promote a deeper understanding of the role of statistics in climatological phenomena including weather modification.

These funds will partially support a conference to bring together the statistical and meteorological communities for discussions on the interface and will gather an international community of scientists.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0017, PROTON EVENT DECAY STUDIES

E.C. Roelof, U.S. Dept. of Defense, Navy, Naval Sea Systems Command, *Washington, District of Columbia* 20362 (DF585360)

Af function - communications and surveillance. Deficiency -inability to predict the decay of solar proton intensities at the earth to the required accuracy. Objective - to determine if selected solar and/or interplanetary parameters may improve the prediction of the decay of solar particle events. How research contributes - the results of this study may provide improved procedures and techniques that may be applicable to real time forecasting.

An investigation of the phenomenological signature relevant to the prediction of the decay phase of solar energetic particle events will be undertaken utilizing the computerized 15-year data base of particle, interplanetary magnetic field, and solar wind spacecraft observations assembled at the Applied Physics Laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, NAVY ENVIRONMENT - FOG/RAIN FORMATION AT SEA

A.H. Woodcock, (No Performing Organization Reported), *Hawaii* (DN323054; N00014-80-C-0397)

The objective of this research is to determine whether there are chemical differences in the nuclei on which some Atlantic coastal fog and some Pacific anomalous rains form. The research would indicate whether differences in ocean nuclei sources should be a fact in the ocean weather forecast for naval operations.

For the conduct of this research cloud and fog drop samples are collected and sized along with measurements of the nuclei size spectrum. Nuclei obtained from evaporation of the drops are subjected to neutron activation and other analysis to

determine iodine to chlorine ration (I/Cl) and other constituents. These measurements are interpreted in terms of the local meteorological situation and physical concepts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0019, INVERSE PROBLEMS IN SCATTERING AND GEOPHYSICS

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Inverse problems arise in problems in which information is desired about a scattering obstacle, a source distribution or an inhomogeneity of a medium from remotely sensed data. Naval applications include reconstruction of a scattering obstacle (ship, aircraft, missile), with sufficient accuracy for classification and identification purposes, reconstruction of soundspeed profiles in the ocean, design of antennas from the desired farfield pattern and identification of location and size and shape of objects buried in the earth or submerged in the water. The objective of this task is to develop mathematical methods for treating inverse problems.

Numerical and analytic techniques will be developed to treat inverse eigenvalue problems. Applications considered will be primarily from geophysics and inverse scattering.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0020, EFFECT OF CONTRAIL CIRRUS ON SURFACE WEATHER CONDITIONS IN THE MIDWEST

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In many regions of the nation, jet aircraft traffic produces large numbers of persistent contrails which contribute to widespread cirrus cloud cover. This research seeks to determine whether contrail-produced clouds have led to measurable effects on surface radiation, sunshine and temperature in the Midwest. Two approaches are being used in this research. First, an analysis of Midwestern historical data of temperature, radiation, sunshine soundings, sky cover, and cloud types, coupled with flight and contrail data. This analysis emphasizes the magnitude and frequency of contrail-produced cirrus and its impact on surface temperature conditions. A second approach focuses on recent case study days when contrail cirrus were developed over wide areas of the Midwest. Days are selected on the basis of data availability including surface cloud camera photographs, specialized satellite observations and in-flight aircraft data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0021, SPACE CRAFT CHARGING AND GEOSYNCHRONOUS ORBIT

J. Feynman, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF583410; F19628-79-C-0031)

AF function - communication, navigation and command. Deficiency -AF space systems are degraded through interaction with the space environment. There is inadequate knowledge of magnetospheric processes at geosynchronous orbit and in polar cap to meet AF requirements. Objective - to model the physical processes at geosynchronous orbit in order to understand how spacecraft build up large electrostatic potentials and how these potentials can be controlled. To investigate electrodynamic structures in polar and aurora region to determine how energy is communicated from solar wind to ionosphere. How research contributes - provides information necessary for building communication satellites that are capable of withstanding radiation damage in severe plasma regimes. Provides information as to how energy is put into the ionosphere and how the morphology of the ionosphere is modified by these inputs.

Analyze data from AF satellites to determine what physical processes are operative under varying external conditions at geosynchronous orbit and in the polar ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, AURORAL OPTICAL STUDY

R.H. Eather, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - prediction and real time specification of ionosphere and aurora. Objective - to specify the ionospheric and auroral conditions in the coverage area of the over-the-horizon experimental radar system (ERS) during the system performance tests (SPT) and to monitor auroral and ionospheric effects on VHF and UHF satellite communications in the Arctic. How research contributes - payoff is through a better understanding of ionospheric and auroral effects on the OTH-B system. This effort will lead to determination of reasons for poor radar coverage of ionospheric origin through accurate mapping of auroral disturbances in the coverage area of the radar.

The airborne ionospheric observatory will conduct 250 hours of airborne missions in the coverage area during SPT. Auroral images from the all sky imaging photometer will be digitized for computer-aided mapping of the auroral features which are the optical signature of large ionospheric gradients within the coverage area. Digital processing will provide a means to fully use the auroral images.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, IMAGING ALL SKY PHOTOMETER

R.H. Eather, Keo Consultants, *Newton, Massachusetts* (DF249780; F19628-76-C-0168)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft, Number 53131, will allow comprehensive measurements of ionospheric response to substorms over subauroral, auroral and polar cap domains.

High time resolution measurements of auroral and airglow optical emissions, with large spatial coverage, will be coordinated with other simultaneous geophysical measurements from the Airborne Ionospheric Observatory, NKC-135 aircraft and from selected ground stations and satellites to provide a means of assessing ionospheric response to magnetospheric substorms over sub-auroral, auroral and polar cap regions. Characteristics of precipitation particles will be derived from the optical measurements and these, together with ionosonde measurements, will be used to study the behavior of the ionospheric E and F regions. Disturbance phenomena such as sudden auroral activations or irregular structures will be well documented to allow direct comparison of the effect of these features on AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, MARINE COMMUNICATIONS INFORMATION SERVICE

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OBJECTIVES: Sea Grant is a research program with a clear mandate to communicate the results of its research activities to the people in the marine community who can put the information to work. To succeed in achieving this objective, the MIT Sea Grant Program established a Communications/Information project to work with all segments of the staff to: make the results of MIT Sea Grant research known and accessible to

diverse user groups; help constituents to locate a range of useful information outside MIT Sea Grant's resources; increase Sea Grant's visibility as a major marine research resource; alert the public to the problems, opportunities and responsibilitis of marine resource development; translate technical information into generally understood language to encourage the application of Sea Grant research.

ANTICIPATED BENEFITS: Underlying all of the project's activities is the aim of effectively transmitting the national Sea Grant Program's research results to the American public and to other nations who share in the development and management of the world's marine resources.

By publicizing the Quarterly Report we hope to increase the number and scope of our audience nationally and internationally. We also hope to alert more of the general public to Sea Grant's potential role in providing valuable information for sound decision-making and resource development. We will use the annual report, brochures prepared for our advisory and education staffs, and slide-tape shows. We also hope to place more articles and news releases in the general media. An updated Citizen's Guide to Coastal Resources in Massachusetts, a revised publication directory, and our newly installed vertical filing systems will bring more information sources to more constituents in the marine public and to the research community at MIT and at other universities in our region.

IDENTIFIED BENEFITS TO DATE: The number of research and advisory reports produced by our staff will be increased from 26 to approximately 32 this year. Concurrently, the mailing lists used to publicize and distribute these publications have grown from 2200 people and companies to 2500. 1000 annual reports and 1978 publication directories have reached our marine public through the Quarterly Report, conferences, etc. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0025, RADAR STUDIES OF TRANSPORT BETWEEN THE TROPOSPHERE AND STRATOSPHERE

J.V. Evans, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology & Physical Oceanography, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM80-00060)

This grant provides continued support to secure radar observations of the horizontal and vertical motions in the clear atmosphere that might serve to couple the troposphere and the stratosphere. Data will be gathered over the height range accessible (3.5 less than h less than 20 km) for periods of 24 hours or longer once per month. The horizontal and vertical wind components will be determined at least once every twenty minutes. Unique information will be obtained concerning persistent vertical drifts, as well as oscillatory larger vertical motions (with amplitudes of up to 1.5 m/sec) that appear to be associated with internal gravity waves having periods of an hour or more. This grant funds an observational radar effort together with an associated modeling effort. Observational accuracy will be determined by means of simultaneous smoke releases and 10 um LIDAR measurements. New measurement modes will seek data on the spectra of gravity waves with periods down to the Brunt-Vaisala period. The intensity of the turbulence is expected to determine whether these waves induce vertical transport through the generation of turbulence in regions of stably-stratified shear flow, and to measure the eddy coefficient for this process. The observations are expected to establish whether vertical mixing occurs on the mesocale, e.g., by injection of stratospheric air into the troposphere in a partially irreversible process.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0026, SATELLITE DATA REDUCTION ANALYSIS AND STUDIES

R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF580540; F19628-78-C-0226)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with coordinated experiments and solar and geophysical parameters to develop improved atmospheric models. How research contributes - permits development of accurate density forecasting techniques.

A MESA accelerometer was flown on each of three atmosphere Explorer satellites. High accuracy, high resolution density data are obtained from this experiment. Telemetry data from this experiment, the EUVS experiment, and other coordinated aeronomical measurements are stored in a Sigma-9 computer at NASA/GSFC. Data are processed and accessed using a remote terminal at AFGL. Studies are to be performed to improve knowledge of atmospheric variability. Density, composition and temperature measurements will be analyzed to develop more accurate models of the geomagnetic activity effect. Also, variations related to solar radiation, latitude and local time will be investigated to provide empirical models of the neutral atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, ELECTRON SOURCE AND SENSOR DEVELOPMENT

W.B. Huber, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF583900; F19628-80-C-0019)

AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space vehicles in the upper atmosphere. Objective - to design and construct instrumentation to be flown on a rocket payload in support of an IHWU program to study and determine Air Force applications of rocket and satellite-borne charged particle ejection systems. How research contributes - the instumentation will be flown on a sounding rocket payload to provide space environment test data to help determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on space vehicles.

A study of state-of-the-art instrumentation for measuring charged particle ejection effects on space vehicles will be performed. Based on this study, sensors will be designed, developed and constructed for measuring electrical effects on a sounding rocket payload during periods of charged particle ejection. A programmer will be developed and constructed to coordinate sensor measurements and particle ejection levels. An electron source for emitting a wide dynamic range of currents and particle energies will be designed and constructed. All the instrumentation will be integrated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, LUNAR LASER RANGING THEORY AND ANALYSIS

D.H. Eckhardt, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583780)

AF function - inertial guidance. Deficiency - irregularities in the earth rotation rate are error sources for inertial guidance instrumentation as well as for astro-geodetic surveys. Objective - to investigate the value of lunar laser ranging data for monitoring earth rotation. How research contributes - test and calibration of advanced inertial sensors requires improved information on earth rotation irregularities, this research will provide and evaluate one method for acquiring such information.

Earth-moon dynamical theory will be refined and Earth-moon laser measurements will be analyzed for improved resolution of earth rotation. Lunar rotation variations (noise) will be more accurately modeled to separate them from earth rotation variations (signal). Earth rotation measurements from lunar laser ranging will be compared with measurements of conventional astrometry and very long baseline interferometry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, MID-RANGE INFRARED SURVEY OF LOW PRESSURE AIR

A. Fairbairn, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583050)

AF function - detection, surveillance, early warning, reconnaissance target acquisition. Deficiency - fluctuations in optical and infrared backgrounds interfere with and degrade the performance of target detection systems, auroral events or nuclear detonations contribute strongly to background fluctuations. The physical and chemical effects of these phenomena, which deposit electron in the upper atmosphere are not well enough understood so that sensor outputs can be corrected to minimize the interference. Objective - to survey the mid-range infrared radiation (4 to 20 micrometer) emitted by low pressure air impacted by electrons. How research contributes - payoff is through better predictability of the effects of fluctuations on infrared systems and to provide spectral bandpass information for future designs.

Low pressure air, pressures up to 0.1 torr, and oxygen-nitrogen mixtures will be acted upon by electrons in the LABCEDE facility. This uses a liner cooled to 80 degrees k to reduce infrared background radiation and enhance sensitivity. The most intense spectral features will be observed with bandpass filters and further examined with a half meter-grating monochrometer. The data will be analyzed for spectral content, species identification and intensity. The effects of gas composition, pressure, and electron excitation conditions will be the main experimental parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, BEAM-PLASMA INTERACTION STUDIES

J.R. Jasperse, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584680)

AF function - satellite survivability, communications and surveillance. Deficiency - the characteristics of energetic charged-particle beams injected in the Earth's ionosphere and magnetosphere are not understood well enough to assess the space-environmental effects produced by such beams. Objective - to develop knowledge of the injection, propagation, reflection and deposition of energetic electron beams in the Earth's ionosphere and magnetosphere. How research contributes - will provide an understanding of radio-wave emissions, secondary electron production and vehicle charging which result when an electron beam is ejected from a vehicle in space.

A study to determine the feasibility of performing scaled laboratory experiments will be conducted. Radio-wave emissions and secondary electron processes will be studied. Certain instabilities resulting from the beam-plasma interaction will also be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, LASER EXCITATION OF ATMOSPHERIC CONSTITUENTS

D.H. Katayama, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582800)

AF function - environmental impact of aerospace vehicles. Deficiency - detection and effects of aircraft effluents on the atmosphere. Objective - measure laser excitation parameters of atmospheric constituents. How research contributes - rotational structures of important constituents will be obtained by laser-induced fluorescence techniques for identification and temperature determination purposes. Wavelengths at which strong fluorescence signals occur will be determined for detection purposes and excited states of aeronomic interest will be studied.

A computer controlled high resolution dye laser will be set up and apparatus for fluorescence experiments will be designed and constructed. During the construction period, joint experiments with scientists at other institutions will be conducted to keep abreast of latest developments in this field. Laser fluorescence experiments will commence when the experimental setup has been completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, COMPARISON OF ROCKET AND DMSP DENSITY DATA

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581230)

AF function - low altitude operational satellites, airborne surveillance and ballistic weapon delivery. Deficiency - inadequate density data base at critical altitudes. Require improvement in computational accuracy of ephemerides for low altitude operational satellite and ICBM trajectories. Objective - provide calibration data for DMSP satellite with onboard SSD package used to determine density on a global scale. How research contributes - in situ rocketborne density measurements made during satellite pass will enable significant intercomparison of observations to be made with the remote sensing technique of the supplementary density sensor (SSD).

PZL densitometer (10 inch falling sphere) payloads will be launched at an appropriate time during a pass of a DMSP satellite with an onboard SSD package for remotely sensing density. Near simultaneous rocketborne measurements of composition, optical emissions and solar EUV will also be made and the acquired data will be analyzed to assist in the evaluation of data from the DMSP/SSD package and to study the thermospheric heating sources and energy balance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, HIGH LATITUDE ATMOSPHERE RESPONSE TO GEOMAGNETIC HEATING

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584440)

AF function - ground, airborne and satellite radio communicators (VLF-VHF) and operations of satellite systems. Deficiency - D- and E-region ionization during stable auroral conditions and geomagnetic disturbances severely effects the operation of communications systems and is accompanied by heating that effects low altitude satellite ephemerides. Objective - to investigate the high latitude polar atmosphere response to the nighttime continuous aurora (Auroral E), the daytime aurora, and to a major geomagnetic disturbance (Energy Budget Campaign). How research contributes - the neutral atmospheric density and temperature measurements needed to study and understand the processes of the disturbed upper atmosphere will be made as a part of three cooperative rocket programs. The program for the continuous aurora will measure the energy input and atmospheric response under conditions where the relatively stable conditions should permit theoretical models and calculations to be checked. Another program will study the atmospheric conditions during a daytime aurora in conjunction with measurements of IR emissions. The energy budget campaign will investigate the poorly understood effects associated with a major geomagnetic storm, our participation in the FRG-sponsored Energy Budget Campaign will make available, on a cooperative basis, the results of this major study of the upper atmosphere. The results from these three programs will form a basis for our understanding of heating sources and geomagnetic storm effects on ionospheric propagation and neutral atmospheric structure.

A 25cm diameter falling sphere instrumented with a three-axis piezoelectric accelerometer will be launched together with other experiments on a rocket payload during the Auroral-E Program in 1981 from Poker Flat Research Range (PFRR). Two falling spheres will be launched together with chemical release payloads (provided by University College, London) from Kiruna, Sweden. The sphere measurements will provide mass density and temperature measurements between 40 and 160 km for both programs. Another 25cm diameter falling sphere will be launched at PFRR in conjunction with instruments for measuring IR emissions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS

S.P. Worden, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580810)

AF function - communications, surveillance, detection, tracking. deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to test and perfect necessary hardware and software for use with large astronomical telescopes to produce high resolution data on earth-orbiting satellites. How research contributes -successful implementation of satellite surveillance utilizing the full high resolution capability of large astronomical telescopes will extend Air Force capabilities in the surveillance and monitoring of satellites by a factor of at least 50 in spatial resolution. Moreover, the extension of these techniques for use on newly developed and proposed multiple mirror telescope systems would increase this capability by up to a factor of 500. The impact of these image reconstruction systems on task objectives will be to provide higher resolution images of solar features than available with present equipment.

Instrumentation currently being developed under the lab director's fund project ILIR7A01 will be used to determine the limiting brightness of objects for which high spatial resolution information can be obtained. Towards this end a variety of test targets (satellite and solar system objects) will be studied, utilizing University of Arizona equipment and telescopes to be provided under contract with Arizona. Orbits for selected satellite test targets are to be provided by the aerospace corporation. Studies incorporating the new University of Arizona multiple mirror telescope will determine whether multiple mirror telescopes may be used to obtain speckle interferometry data. This new instrument has an aperture equivalent to a conventional 7 meter telescope, and exceeds by a factor of 1.5 the largest existing telescope. It is the prototype for a class of new telescopes which may eventually exceed 30 meters in diameter. Such telescopes could in principle detect spatial structure smaller than 1 meter in extent on a satellite in synchronous Earth orbit. Harvard University will develop under contract advanced image processing techniques for application to extended objects like the solar surface and larger satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, FOREST RESOURCE MANAGEMENT APPLICATIONS OF DIGITAL IMAGE PROCESSING

T.M. Lillesand, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0079696; MIN-42-038)

OBJECTIVE: Determine the need for and form of radiometric calibration of forest resource photography; determine the form and evaluate the utility of digitized photography in forest type mapping and insect and disease assessment; improve, as appropriate, the integration of conventional photointerpretation, densitiometric analysis of digitized aerial and space photography and automated analysis of LANDSAT data for forestry applications; and , define the technological form and measure the costs and benefits of merging digital remote sensing procedures with conventional interpretation techniques.

APPROACH: Photograph test area at multiple altitudes using color infrared film under a range of atmospheric conditions. Sensitometrically calibrate photographs and develop model to compensate for atmospheric effects and film processing variations. Digitize photography using a scanning microdensitometer and apply calibration model to 'automate' the process forest-type mapping. Perform similar analysis using digital LANDSAT data. In both cases, integrate 'manual' interpretation to guide the computer mapping efforts. Assess the benefits of using digitized photographs, LANDSAT data, and conventional interpretation (first separately, then jointly) in terms of forest cover classification accuracy, as measured by field verification. Compare costs of various methodologies.

PROGRESS: Forest resource photography (1:20,000 and 1:90,000 color infrared) and LANDSAT data have been acquired for the Cloquet Forestry Center in northeastern Minn. The LANDSAT data have been computer processed to enable 'automated' sampling of cover types in the test area. Assessment of the accuracy of this process is underway. The aerial photography has been digitized using a scanning denistometer and it is currently being analyzed to compare the accuracy of the digital classification at the two test scales. An assessment of an integrated digital and manual approach to mapping wetland cover types both with Landsat and aerial photography was completed in a test area in the Twin Cities metropolitan area. Multidate color infrared photography has been acquired over two Dutch elm disease study areas in the Twin Cities. The photography is currently under analysis.

SUPPORTED BY Minnesota State Government

5.0036, VOLCANIC GASES FROM MT. ST. HELENS

R.E. Stoiber, Dartmouth College, School of Arts & Sciences, Dept. of Earth Sciences, *P.O. Box 833, Hanover, New Hampshire* 03755 (EAR80-20796)

This project involves monitoring the sulfur, chlorine, and fluorine emissions from Mt. St. Helens. Sulfur dioxide will be monitored by remote sensing using a correlation spectrometer. HC1 and HF will be determined by leaching from fresh ash and from fumarole condensates. This study will build upon data collected during the early phases of the eruption and will provide time-series data on gaseous emissions from the active volcano. These data are of scientific interest as well as potential usefulness as eruption forecast aids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0037, THE ARCTIC STRATUS EXPERIMENT CLOUD-AEROSOL INTERACTIONS

V.K. Saxena, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Geosciences, *Raleigh, North Carolina* 27607 (DPP79-22837)

As part of the Arctic stratus cloud experiment planned to take place in the vicinity of Point Barrow, Alaska, using the NCAR Electra aircraft, the research project is aimed at obtaining a microphysical understanding of the formation, persistence, and dissipation of the stratus clouds. Measurement will be made from the Electra aircraft on the activity spectrum of the cloud condensation nuclei (CCN), the Aitken nuclei concentrations, and the volatility of the CCN. These measurements will be used to derive horizontal and vertical, spatial and temporal distribution of the Arctic aerosol, delineate cloud aerosol interactions, study the variations in the cloud droplet size distribution with the water vapor flux divergence and the initial CCN spectrum, assess the strength of sources and sinks of the Arctic aerosol, study the aerosol transport across the temperature inversion layers, and determine whether the origin of the Arctic aerosol is marine, continental, or stratospheric.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0038, GEOLOGIC INVESTIGATIONS WITH INTEGRATED GEOPHYSICAL AND REMOTELY SENSED DATA

D.G. Orr, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198

STATES TO WHICH PROJECT PERTAINS: New Mexico, Alaska.

Digital gravity over Claunch, New Mexico, will be integrated by image analysis equipment with aeromagnetic, topographic and LANDSAT data. Various displays of the integrated data will be analyzed and compared with geochemical and luminescence data acquired during FY 79. Anomolous surface and subsurface patterns will be field-checked. Structural contour maps of the Umiat area, Alaska, will be digitized and integrated with remotely sensed data and other geophysical and topo-

graphic data to identify surface expression of subsurface features.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0039, FOREST METEOROLOGY AND CLIMATOLOGICAL STUDIES

B.A. Hutchison, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Atmospheric Turbulence & Diffusion Lab., *P.O. Box E, Oak Ridge, Tennessee* 37830 (AI05-76EV03688)

The ATDL Forest Meteorology Project conducts basic research on meteorological mechanisms and processes that occur within and above the forest which are of importance to DOE concerns in areas of terrestrial ecology, dispersion and deposition of materials and energy transported by the atmosphere over forested regions, and effects of forest covered complex terrain upon atmospheric transport and removal processes. The approaches used in this research effort range from standard meteorological research techniques to innovative, original measurement methods as required. Primary research emphasis of this project is upon deciduous forests; however, a conifer forest (loblolly pine plantation) is partially instrumental for studies requiring a more uniform and homogeneous canopy or a level site. Because of the paucity of data and information available regarding wind and turbulence in forests, this research program predominantly involves experimental field studies. However, staff of this project work closely with theoreticians employed in other ATDL projects so as to facilitate progress in both field and theoretical aspects of forest meteorology. This program of research is designed to further our understanding of turbulent transport and deposition mechanisms in forest canopies. Anticipated benefits accruing from this increased knowledge include assessments of the ability of forests to cleanse the atmosphere of various kinds of pollutants, increased abilities to assess ecological consequences of environmental pollution, and a furthered understanding of coupling between the abiotic and biotic portions of the environment.

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SUPPORTED BY U.S. Dept. of Energy, Office of Environment

5.0040, NAVY ENVIRONMENT STORM PROBES AND SONDES

A.A. Few, Rice University, Graduate School, Dept. of Space Science, *6100 Main St., Houston, Texas* 77001 (DN123363; N00014-75-C-0139)

Toward the ultimate objective of improving the mesoscale weather forcast that involves a broad area of cumulus and thunderstorm activity, the immediate objective of the research is to obtain as many vertical profiles as possible of electrical parameters in as many storms as possible during the Thunderstorm Research International Program (TRIP). These profiles will be observed during the time that other participants in TRIP will be making their separate observations.

This phase of the research is involved with analyzing the thunderstorm electric field data accumulated during TRIP 1979 at Socorro, New Mexico. The contractor is also engaged in cooperative interpretation of this data with other investigators.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0041, SUBSTROM-ASSOCIATED BIRKELAND CURRENTS UTILIZING THE IMS DATA BASE

J.N. Barfield, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (ATM80-17892)

This grant will support a detailed study of the Birkeland current systems which flow in the Earth's magnetosphere and ionosphere during magnetospheric substorm activity. For this study a number of data sets will be used which were compiled as part of the International Magnetospheric Study (IMS). These include magnetic field measurements from the North American IMS magnetometer network, the Air Force Geophysics Laboratory magnetometer network, the NOAA GOES synchronous satellites, the SCATHA satellite, and the TRIAD satellites. Data from the DMSP satellites and other supporting data will be used when appropriate. The principal interval of study will be 1978-1979, during which data was available from the entire set of data sources. Earlier intervals will be studied when appropriate.

In this study, emphasis will be placed on simultaneous measurements in space and on the ground. The primary topics of study are: (1) the global-scale magnetospheric signature of substorm-associated Birkeland current systems, (2) correlation of the intensity of Birkeland currents and ionospheric currents, and (3) cross-calibration of ground-based and satellite magnetometer data. The overall aim is to understand the current systems of the magnetosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0042, COMMERCIAL AIRCRAFT DATA COLLECTION FOR MONEX

E.G. Astling, Utah Higher Education System, University of Utah, School of Mines & Mineral Industries, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (ATM78-19895)

The objective of this project is to collect, digitize and archive flight level commercial aircraft wind and temperature observations over the south and southeast Asian Monsoon Experiment (MONEX) region. MONEX is a regional subprogram of the Global Atmospheric Research Program (GARP) which will occur at the same time as the First GARP Global Experiment (FGGE) also known as the Global Weather Experiment. The observations will be collected during two (summer and winter) intensive Special Observing Periods (SOP's) of one month each.

The data will be made available to MONEX scientists who will use them to supplement the other conventional and special observations collected during MONEX. They will also be used primarily for global numerical weather simulation and prediction work.

Aircraft crews will be asked to take the observations at 250 km. intervals along the flight tracks whenever the aircraft are above 6 km. The observations will consist of wind direction and speed and air temperature with time, altitude and location data. About 100 aircraft are equipped with automated data processing systems. These data will be added to the observations collected by crews on other aircraft to enhance the total data set.

MONEX is an experiment to increase understanding of the dynamics and thermodynamics of the atmosphere and ocean in the monsoon region of the world where the local monsoon wind and precipitation regimes are the most energetic on the globe. The Global Weather Experiment is designed to test and improve computerized global weather prediction models.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, LIGHT SCATTERING AND RADIATIVE TRANSFER BY ICE CLOUDS

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industries, Dept. of Meterology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (ATM78-26259)

This project is a program of experimental and theoretical research on light scattering by nonspherical ice crystals. It includes the experimental determination of the single-scattering parameters and phase matrix for artificial ice crystals with various shapes and sizes for wavelengths in the solar and infrared spectral regions through controlled laboratory experiments.

The research also involves the theoretical evaluation of the single-scattering and polarization parameters for hexagonal crys-

tals by means of the geometrical ray tracing and the numerical method for symmetrical particles.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0044, LAND USE PATTERN ANALYSIS
J.L. Place, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (G-12)

STATES TO WHICH PROJECT PERTAINS: Florida, Georgia, Maryland, Virginia, Washington, Alaska, Colorado.

A broad and continuing project to analyze and interpret patterns of land use and land cover in the United States is being carried out under four subprojects: (1) USGS land use area measurements for citrus groves in Florida are being interfaced with computerized data from the census of agriculture. Dr. Carl W. Spurlock of the University of Florida is conducting this work for the USGS. (2) Dr. Spurlock will also do a comparative study of urban land uses in Florida SMSA's. (3) Professor John Fraser Hart of the University of Minnesota is continuing investigation of land use and land cover in the Southern Piedmont using USGS area measurements and maps. (4) Experiments are continuing on the use of LANDSAT and SEASAT data for improving discrimination of glacial ice from permanent snow fields and of wetland forest from dryland forest.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0045, INVESTIGATION OF CLOUD POPULATIONS IN RELATION TO SYNOPTIC CONDITIONS OVER THE BAY OF BENGAL
C. Warner, University of Virginia, School of Arts & Sciences, Dept. of Environmental Sciences, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM80-12214)

The objective of this research is to study the forms and characteristics of clouds that occur under varying weather conditions during the southeast Asia summer monsoon. The principal investigator participated as a research scientist in the field phase of the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP), during July 1979. He made visual and photographic observations of clouds on a series of aircraft flights over the Bay of Bengal during different monsoon conditions. He will integrate those observations with radar measurements as well as with other MONEX data on winds and thermodynamics, and use this synthesized set of observations in order to attain his objective.

This work will provide scientists studying large-scale monsoon dynamics with information on the interrelationship of smaller-scale clouds with the large-scale monsoon flow.

The monsoons not only influence weather and climate locally, but also on a global scale. For this reason they are being studied by GARP.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0046, RELATIONSHIP OF GLACIER BASAL CONDITIONS TO SURFACE VELOCITY, STRAIN-RATE, AND SEISMIC ACTIVITY
C.F. Raymond, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98195 (DPP79-03942)

It is proposed to continue observations on the variations and controlling factors of basal sliding in the surge-type Variegated Glacier in a joint effort by California Institute of Technology, University of Alaska, and the University of Washington. Direct measurement techniques using boreholes were started in 1978 at a site where indirect estimates of sliding rate showed high values and dramatic summer-to-summer increases indicative of the impending surge expected from historical periodicity to occur in the early 1980's. Successful direct measurement of sliding rate borehole inclinometry verified the indirect estimates made at this location. Monitoring of water pressure revealed major changes in time and an overpressurization of the basal hydraulic system in relation to internal systems, which has never before been recognized observationally or theoretically, and may be important in understanding the unusual sliding behavior deduced for this part of the glacier. To build on these observations, additions to existing drilling and reaming equipment are proposed which allow direct short timescale measurement of sliding velocity and structural features of the basal zone by already proven photographic and TV methods even in conditions of basal water overpressurization which prevented success in 1978.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0047, NAVY ENVIRONMENT - CLOUD PHYSICS
J. Latham, University of Manchester, University of Manchester Inst. of Science & Technology, *Sackville St. 1 Lancs, P.O. Box 88, Manchester, England, United Kingdom* (DN475237; N00014-77-G-0027)

The objective of this research is to study the evolution of the drop size spectrum of both a cumulus and a stratus cloud. The naval application will be to better modelling of light transmission through clouds in support of electro-optic systems and improved visibility forecasts.

This research will be conducted initially in the laboratory in preparation for one of the initial flights aboard the Space Shuttle. The preparation will require some modification of the University of Missouri Design Chamber (ONR Contract N00014-75-C-0182) to include air jets to simulate cloud entrainment of drier air. The continuous measurement of the drop spectrum in the space chamber will probably be by a disdrometer being developed under ONR Contract N00014-76-C-0436 with the University of Missouri.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LIFE SUPPORT EQUIPMENT RETRIEVAL PROGRAM (DA0C6897)
T.A. Hundley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0167)

To provide a technological data base concerning the physiological and biomedical aspects of the evaluation and injury correlation of life support equipment, identification of hazard protection problems associated with life support equipment and to provide conceptual design recommendations and criteria for the improvement of life support equipment.

Army aviation life support equipment involved in either injury causation or prevention, in field, are sent to USARL for biomedical and injury correlation evaluation. This evaluation assesses the effectiveness/deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred and the related human dynamics involved in the accident. The analysis is accomplished by the application of epidemiologic methods incorporating medically related engineering failure mode analysis, accident investigative procedures, forensic pathology, mathematical modeling and applied bioengineering research techniques.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, ATTENTION AND TASK COMPLEXITY AS INDICATED BY PHYSIOLOGICAL INDICES
E. Lindholm, Arizona State University, School of Liberal Arts, Dept. of Psychology, *Tempe, Arizona* 85281 (DF223350; F33615-77-C-0069)

To develop physiological measures of pilot attention and task load for use in flight simulation research studies. Ultimately these physiological measures will be used in conjunction with behavioral measures of pilot attention and task difficulty, in order to optimally structure flight simulation training programs and equipment.

Task difficulty will first be manipulated with standard information processing tasks which have reliable behavioral measures. The purpose of this phase is to determine the physiological responses which are most consistently related to behavioral responses. Later, behavioral and physiological measures will be taken with a secondary task technique combining two relatively simple information processing tasks which provide a more realistic approximation of actual aircraft flight.

SUPPORTED BY U.S. Dept. of Defense, Human Resources Lab., Flying Training Div.

6.0003, UPT DATA BASE
M. Starr, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223250)

To identify long-term effects of diverse viarables on flying performance, to determine the relationship between daily grades and check grades, and to evaluate practice requirements and student progress rates (i.e., readiness to learn) during various phases of UPT by studying UPT grades and other appropriate measures. The primary objective is the establishment of a single UPT data base. The secondary objective is the conduct of statistical investigations on the data base.

The daily flying grades will be obtained from Air Training Command. This data will be formatted for analysis by AFHRL/FT. As a minimum, the data will also include syllabus flight number, maneuver identification, and IP grades. A series of statistical analyses will be performed on the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, LDF 79-2, AIRCREW PROTECTIVE RESTRAINT SYSTEM EVALUATION PROTOTYPE
B. McDonald, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF325320; F33615-79-C-0522)

Recent aircraft accident experience has resulted in high level reemphasis on techniques and equipment for aircrew restraint and escape. It is apparent that new approaches will be needed in order to achieve significant improvements in the injury and fatality rate. This effort will evaluate the feasibility and utility of novel concepts for aircrew protection against multiaxis acceleration associated with projected operational and escape environments.

The biomechanical protection branch is engaged in an advanced design contract effort to conceptually evaluate a number of innovative techniques in aircrew restraint system design. The techniques include adaptive support and restraint surfaces, powered torso and head reorientation, and conformable seat cusions for restraint and escape systems. These techniques are presently in the conceptual stage of development and will reach the design aid mock-up stage. The opportunity will then be available to pursue an aggressive aeromedical evaluation of the concepts establishing the potential for reduction in morbidity and mortality associated with escape. Improved operational restraint configurations also have potential for improving the performance of the human operator subject to multiaxis acceleration. Funding will be used to establish a contract effort to produce conceptual prototype equipment suitable for human centrifuge and impact testing of the aeromedical aspects of the concepts discussed above. The result of this effort would allow AMRL to pursue the evaluation necessary to substantiate potential improvements to be realized.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0005, WASHOUT EFFECT IN R. A. TRACKING
H. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF320760; F33615-77-C-0508)

Considering the increased use of moving base simulators in the Air Force the requirement for better simulator design criteria based upon human operator technology is timely, but more research is needed in this area. A continuing effort to develop this type of simulation criteria technology is being pursued by AMRL (EM). A significant portion of moving base simulator design is the use of washout circuits to limit simulator motion. A criteria that can be linked to pilot performance is desirable. The objective of this research effort is to formulate an experiment that can accomplish this in the roll axis, perform the experiment, collect data and analyze the data. From the results, optimum washout design criteria and human operator models for the roll axis will be formulated. The results of this effort are needed by AFHRL, AFFDL, and AMRL for improved design of motion base simulators.

The contract with Systems Technology, Inc. was extended to include phase 7-tie in with LAMARS simulator for the purpose of designing, participating in the conduct of, analyzing, and documenting a sway axis washout/coordination experiment on the AFFDL LAMARS simulator. A purchase request has been submitted to further extend the contract to include phase 8-DES transient motion experiment, for the purpose of assisting in the upgrade of the AMRL DES simulator dynamics and in the design, conduct, analysis, and documentation of a follow-up roll axis washout experiment.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0006, GZ EFFECTS ON HUMAN OPERATOR PERFORMANCE
D.L. Klienman, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Electrical Engineering, *Box U-37, Storrs, Connecticut* 06268 (DF324400; F33615-78-C-0517)

The intent of this workunit is to upgrade the TAC Avenger air-to-air engagement model with an improved human tracking model subroutine which includes the effects of high-g forces on pilot performance.

The University of Connecticut will extend the optimal control model to include the effects of high g forces on pilot performance in an aerial tracking task. Static tracking experiments will be conducted by the University of Connecticut including a study of the effects of gun sight lead computing dynamics. Motion based g-stress experiments will be performed at AMRL using the Dynamic Environment Simulator (DES). The experimental program conducted at the University of Connecticut will concentrate on determining the effects of target motion and visual cues on tracking performance. Air-to-air tracking on the DES will be studied to analyze the interplay between attacker aircraft dynamics and target movement, and to refine the static model.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0007, HUMAN PERFORMANCE MEASUREMENT IN AIR SYSTEMS
D.A. Norman, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN221040)

To improve control of the training process and of computer-based training systems in particular through development, test and evaluation of a comprehensive subsystem for the measurement of human performance. The availability of precise and relevant assessment structures can increase training effectiveness by giving a true picture of skill acquisition level at any point in the training process.

Identify appropriate training settings; select a class of desired trainee behaviors for exhaustive analysis; define and implement a measurement structure based on a measurement subsystem of adequate complexity; conduct empirical tests to evaluate techniques for discriminating among candidate members of a measurements pool; investigate the utility of highly refined mea-

surement subsystems in training process control, e.g., ability to predict the trainee's readiness to transfer.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0008, ATMOSPHERIC CHEMISTRY - OZONE AND STRATOSPHERIC POLLUTANTS

J.H. Hall, Atlanta University Center Corp., *360 Westview Dr. S.W., Atlanta, Georgia* 30310 (S06 RR 08006-100013)

This project is part of a broader program (RR 08006-10) whose summary states: The main objectives of the proposed Biomedical Sciences Research Improvement Program (BISRIP) are to facilitate and increase staff research productivity in the biomedical sciences and make the science departments in the Atlanta University Center more effective in preparing students for research in these fields. To implement these basic objectives, this program proposes to provide those funds, equipment, ancillary resources and supporting facilities that would enable scientists in the Center to develop their research potential. With the support provided individual discipline-oriented research projects as well as team or interdisciplinary projects contemplated but not launched may be initiated. Also with graduate student support, more participants may enter into the Ph.D. programs offered by the Chemistry and Biology Departments and enter into biomedical research careers.

Renewal funds are being requested for the direct support of research projects (faculty released time, graduate and undergraduate research participants, salaries for investigators, equipment, supplies, postdoctoral and technician positions) in the following broad categories: Experimental Psychology, Biochemistry-Molecular Biology, Developmental Biology, Biomedical Computer Research, Cancer Research, and Heart Lung Research.

In order to support the center concept of inter-institutional cooperation: to eliminate the duplication of costly equipment, and, at the same time, to increase access to these services, funds are being requested to alterate and renovate space in the soon-to-be-constructed AUC Science Complex to house the BIOSER Center.

BISRIP will increase the effectiveness of the Atlanta University Center Science Research Institute, and as the sponsoring agency, it is incumbent upon the Institute to assume the responsibility of continuing the objectives of the program after the expiration of the grant.

SUPPORTED BY U.S. Dept. of Health & Human Services, National Inst. of Health, Div. of Research Resources

6.0009, DEPTH PERCEPTION IN VISUAL SIMULATION

G. Harker, University of Louisville Foundation Inc., *2301 S. 3rd St., Belknap Camp. c/o U Louisville, Louisville, Kentucky* 40208 (DF228610; F33615-78-C-0021)

Task analysis of landing, aerial refueling, formation flight, and low altitude tactical manuevers (including low level navigation and air-to-ground weapon delivery) will be used to assess the depth cues used by pilots in actual flight situations. A literature search will examine knowledge of human depth perception to establish possible cue requirements for simulation of these tasks. On the basis of this analysis, psychophysical/perceptual experiments will be designed to provide supplementary information if needed, and briefed to AFHRL for possible future work. Recommendation of changes needed in visual simulation systems, including analysis of expected impact of those changes, will be made. Capt. George Buckland is the co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, A FOUNDATION FOR SYSTEMS ANTHROPOMETRY

H.M. Reynolds, Michigan State University, School of Osteopathic Medicine, Dept. of Biomechanics, *Soil Science Bldg., East Lansing, Michigan* 48824 (DF050530; F49620-78-C-0012)

AF function - in day-to-day operations, aircrew members are exposed to a number of dynamic situations such as being subjected to maneuvering forces (g), buffeting, and vibration. A new anthropometry which takes into account such dynamics in the design and operation of crew stations is required. Deficiency - conventional anthropometry provides static dimensions measured on subjects rigidly posed in highly standardized positions, and does not meet requirements for describing body motions in dynamic situations. Objective - a three-dimensional systems anthropometry will be developed which treats the body as a dynamic system. The model will optimize the number of links needed for description of body movement and mobility for workspace design and acceleration/deceleration/simulations. How research contributes - the lack of such an anthropometric system is a significant road block to providing criteria central to the design of sophisticated human analogs, both physical and mathematical. This basic human engineering research program will lay the required foundation for using new anthropometric systems which are in sight in the near future.

A means of spatially identifying anatomical and anthropometric landmarks suitable for three-dimensional coordinate description will be developed. Procedures are being developed specifically to define external morphology, internal skeletal geometry and coordinate systems, and also provide a means of relating the new anthropomechanic data to the extant classical anthropometric data. Phase 2 will provide the methodology necessary to describe the human anthropomechanic system for one body region--the lumbar/pelvic/femur linkage system. Joint centers of mobility in the thoracic/lumbar linkage system will be studied during phase 3 in preparation for the major task of relating the shoulder to the hip during phase 4. In addition, differences in body size and differences within the same individual will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, IN VITRO CHEMICAL CARCINOGENESIS AND CO-CARCINOGENESIS IN HUMAN CELLS INITIATED BY HYDRAZINE AND POLYNUCLEAR COMPONENTS OF JET FUEL

G.E. Milo, Ohio State University, Columbus Campus, School of Veterinary Medicine, Dept. of Pathobiology, *1900 Coffey Rd., Columbus, Ohio* 43210 (DF049220; F49620-77-C-0110)

AF function - the AF uses many unique chemicals to obtain optimum performance of its aircraft and missile weapons systems. National legislative and regulatory controls on the use of energetic chemicals have necessitated a step-function increase in the need to define safe exposure limits and handling practices for these chemicals concurrent with the acquisition of the weapon system. Deficiency - there is a need to investigate mechanisms and to devise methodologies to predict, detect, measure and modify pharmacological manifestations of the unique chemicals associated with USAF weapon systems in order to protect personnel from health and performance degradation. Research is needed to determine and identify actual molecular mechanisms of chemical carcinogenesis. Objective - the objective of this research is to elucidate the mechanisms producing changes in cell chemistry, DNA and RNA and to correlate these with the metabolic and biochemical state of the cells following exposure to hydrazines and PNH's. How research contributes -this research contributes directly to Subarea 1.8, 'Environmental Protection and Toxicological Hazards.'

Studies will examine the cytotoxic and carcinogenic potential of hydrazine and polynuclear hydrocarbons in synchronized and nonsynchronized normal human cells, investigate damage to cellular DNA by studying unscheduled repair kinetics and alterations in cellular-associated RNA-directed DNA polymerase activities, investigate whether the suspect carcinogens act synergistically with viruses to enhance virus transformation of human cells, investigate whether these chemicals activate endogenous RNA-C-type virus expression in human cells, determine whether these chemicals damage cellular DNA, providing additional sites for virus integration. New approaches will include autoradiographic measurement of chemical uptake and cytoplasmic binding using electron microscopy, and determination of the effect of hormones on viral molecular probes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, NO PATHOLOGY THRESHOLD
A. Hall, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320470)

To develop nationally recognized data on chronic inhalation exposure effects of volatile Air Force chemicals and to provide safe occupational exposure limits (threshold limit values) which constitute concurrence with the Occupational Safety and Health Act as directed by executive order. The No pathology threshold portion of Job Order Number 63020620 has been transferred to this new workunit.

To establish an acceptable, non-injury concentration of Air Force chemicals under subacute and chronic exposures for the primary target organs. The methods used will be gross, light microscopy, and electron microscopy of animal tissues exposed to the test chemicals. Hematological, clinical chemistry, microbiological, and immunological findings will be evaluated. Stringent quality control on animals used in subacute and chronic toxicology studies will be maintained. The data and recommendations for safe exposure level are provided the Air Force Surgeon General and the National Academy of Sciences Committee on Toxicology to obtain approved exposure criteria.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0013, OPERATOR HEAD/EYE CONTROL CHARACTERISTICS
J.P. Hornseth, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321040)

The main thrust of this workunit will be to determine the conditions under which it is desirable to use the head or eye for manned and unmanned aircraft piloting, weapon delivery, and sensor control. The research effort will concentrate on determining the natural characteristics of hand, head, and eye tracking, including the effects of environmental stressors on these characteristics. An integral component of the research will be the effects on control performance of image format and location in the visual field of displayed feedback and secondary task information. The results will provide data required for the selection and specification of control-display systems proposed for operational applications. The research will also identify promising new techniques of harnessing the operator in control task situations and suggest further development or prototype application and evaluation.

Experimentation will be conducted in a fixed-base laboratory and in simulated flight environments incorporating vibration and gz stressors. When practical, data from complementary in-flight tests will be used to validate the ground-based results. Operator control performance with a hand controller, the helmet-mounted sight, and the oculometer will be investigated to establish a data base of operator pointing accuracies and frequency response which will document the performance tradeoffs for hand, head, and eye controllers. Concurrent experimentation on a vibration simulator will begin to quantify the effects of a buffetting environment on head control and seek to develop software techniques to compensate for errors induced by the head rotational system's vibration transmissivity. Experimentation to be conducted on the AMRL centrifuge will compare hand, head, and eye control performance under gz acceleration to determine the mode of response that is best for an operator to use in aiming the fire control system in a high performance aircraft. Additional laboratory experimentation will explore natural head-eye coordination. The results will influence the design of the helmet-mounted sight reticle and the development of a helmet-mounted oculometer. This effort was previously reported under Workunit 7184-04-43, Control Concept Development.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0014, ANALYSIS OF AERODYNAMIC DECELERATION INJURIES DURING EMERGENCY ESCAPE
A.J. Nestle, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321450)

Injuries caused by aerodynamic deceleration during emergency escape from high performance aircraft using open ejection seats are a serious problem under non-combat conditions and a major combat ejection problem. These injuries, which may be life-threatening at their onset, also increase the possibility of fatality in final phases of escape, i.e., parachute opening shock, descent, landing impact, post-escape survival and rescue. Aeromedical criteria must be established to support development of protective equipment. The objective of this effort is to-(1) provide medical descriptions of operational injuries, (2) determine the injury mechanisms, (3) establish a basis for prioritizing biomechanical research on this problem and (4) provide aeromedical criteria for injury prediction models and protection techniques.

All accident reports from 1965 to present in which there is a possibility of injury from aerodynamic deceleration will be reviewed in detail. The review, accomplished in collaboration with the Deputy Inspector General for Inspection and Safety, will include analysis of ejection conditions, Flight Surgeon's evaluation of injuries, x-rays and long-term effects of the injuries. Injuries occurring during the investigation will be studied directly on a physician-to-physician basis. Research results will be made available to the Naval Air Systems Command as well as USAF Laboratories and Product Divisions.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0015, VISUALLY ACQUIRED REFLECTIVE GLIDE SLOPE INDICATOR, LDF 79-10
H.L. Task, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325540)

The purpose of this effort is to design, build and test a reflective glide slope indicator that will use the aircraft landing lights as the light source. The VARGSI will provide a color coded reflection of the aircraft landing lights to visually cue the pilot to the correct glide slope angle.

There are several ways in which an optical system can be devised that would be capable of producing the desired effect. Each method has certain advantages and disadvantages in terms of intensity of the reflected light, ease of color coding, complexity and expense. Each design will be evaluated on paper. Working models of one or more designs will be produced and tested under lab conditions. The most promising design(s) will then be field tested to determine visibility and angle sensitivity characteristics under actual outdoor conditions. If the field tests are favorable, it is possible that the device would undergo flight testing. Tentative arrangements have been made with the Army Aeromedical Research Labs at Fort Rucker, AL, to test the final device for helicopter landings. This effort is supported by O&M contract documented under Work Unit 71840006.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0016, HUMAN PERFORMANCE IN MULTIPLE AND/OR ASYMMETRICAL G
D.N. Toth, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323700)

To quantify human performance associated with multiple axes acceleration stressors and to develop technologies to exploit the maneuvering potential of vectored force fighter designs in air-to-air and air-to-ground combat. To formulate a mathematical model to describe human performance under these multiaxes accelerations.

Multidisciplinary research programs involving the dynamic environment simulator (DES), human subjects, g seats, varied controls, restraints, cockpit displays and performance variables will be conducted to develop human operator models and evaluate alternative hardware configuration and pilot performance under multiaxes acceleration. One specific purpose of this research is to establish pilot performance capabilities while flying

in plus or minus 5 gy and a plus or minus 3 gx direct side force maneuvers.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Environmental Medicine Div.

6.0017, EVALUATION OF ITEM CHARACTERISTICS CURVE THEORY TO REDUCE BIAS AND INCREASE VALIDITY

H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234180)

Greater accuracy in estimating airmen ability levels through the use of an adaptive testing method and latent trait theory.

Approximately 1000 word knowledge and arithmetic operations items will be calibrated, obtaining the A, B, and C parameters. Items selected for inclusion in the adaptive test will demonstrate minimized racial bias. Tests will be administered to approximately 400 basic airmen who are designated for the 423, 426, and 431 career fields. Final school performance measures will be obtained and conventional and adaptive test scores will be correlated with these.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0018, MAN-RATING OF LIFE SUPPORT EQUIPMENT

R. Holden, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322660)

During the past four years, a close alliance has evolved between USAFSAM and the 412A Life Support SPO, based largely on the human compatibility evaluation of life support equipment. That work was previously done in Workunit 7164-17-11, and due to a divisional restructuring, was transferred to this workunit. The goal of this workunit is to provide an independent Air Force judgement on the effectiveness of new aircraft equipment, and to identify problems associated with new concepts prior to the cost, risk, and visibility of a field OT&E.

Evaluation of criteria and human compatibility will be documented under this workunit, when data indicate a need for new or revised criteria, specifications, or technology, coordination/handoff to the relevant workunit will occur. Close coordination will be established and maintained with potential USAF customers such as 412A Life Support SPO and ASD. Evaluation requirements are usually short-term and will be partially or fully reimbursed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, ENHANCEMENT OF AIRCREW PERFORMANCE BY OPTICAL EQUIPMENT

B. Kislin, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321970)

Optical devices have the potential to enhance flight crew performance and/or facilitate inflight procedures. In order to insure that AF aircrew are provided with optical aids which can optimize their performance, development and testing of visual devices will be on a continuous basis.

The USAFSAM will respond to operational problems identified from the field for development assistance and/or in planned research efforts where a long-standing need may exist. Filter enhancement for target detection, multifocals designed specifically for cockpit use, and new spectacle frame developments in new plastic materials will be studied. Efforts under this workunit were previously documented as Workunit 7755-09-03.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, AUTOMATED AIDS TO ISD - COMPUTER

J. Maxey, Appli Mation Inc., *1000 Woodcock Rd., Orlando, Florida* 32803 (DN994034; N61339-79-C-0009)

Procure a contract to provide direction, guidance and assistance in the design, development, acquisition, field test and modification of computer related aspects of a prototype system for aiding the application of the ISD process to Navy aircrew training.

Computer hardware and software features will be specified, developed, tested and modified.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

7.0002, AQAM ACCURACY DEFINITION

D. Rote, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (DF408560)

To define the accuracy limits of the air quality assessment model (AQAM) by analyzing data from the ambient air quality survey at Williams AFB. In addition computed versus acoustic sounder AQAM analysis will be analyzed along with further statistical analyses and documentation of the monitor data to better define AQAM's capabilities.

A statistical analysis of the predicted versus monitored air quality data is being performed. In addition, many dispersion and air quality data are being statistically analyzed. The entire study results will be published including reduced data tapes for NTIS.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

7.0003, STOCHASTIC FILTERING AND CONTROL

T.E. Duncan, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Mathematics, *112 Bailey Hall, Lawrence, Kansas* 66045 (DF046660; AFOSR-77-3177)

AF function - the study of Air Force aerospace systems and conventional systems. Deficiency - the control of a linear system is a mathematical straightforward task. However most physical systems are inherently nonlinear and need new techniques for control. Objective -the objective of this research is to investigate the stochastic filtering and control of stochastic systems which are modelled by stochastic differential equations in the tangent bundle of a smooth manifold. How work contributes - success here would result in improved performance of physical Air Force systems.

Research will proceed in various problems in stochastic filtering and control. The study of the family of symmetric transfer functions for minimal systems will continue to be investigated with emphasis on electrical network realizations for transfer functions for pure delay time systems. An algebra-geometric approach to problems of filtering and control for linear pure time delay systems will be pursued to enhance the practical application of such results. In particular, the steady state problems of filtering and control will be studied. A convariance realization problem for systems with delays will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, COMPUTER-BASED UNDERSTANDING OF MECHANISM OPERATION AND CONTROL

A. Rosenfeld, University of Maryland, College Park Campus, Computer Science Center, *College Park, Maryland* 20742 (DN675260; N00014-76-C-0477)

The Navy has need for advanced automatized analysis and control of mechanism operations. This task is to develop interactive computer systems procedures and techniques to assist in

such tasks as technician training, mechanism repair procedures, and automatic repair maintenance and control.

The approach is to develop a computer-oriented system of representation for describing, at a conceptual level, how an arbitrary device or mechanism works. The representation will closely model the representation people use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, CALCULATION OF TERNARY PHASE DIAGRAMS BY COMPUTER METHODS

L. Kaufman, Manlabs Inc., *21 Erie St., Cambridge, Massachusetts* 02138 (DMR79-11916)

Calculation of ternary phase diagrams depends upon definition of lattice stability, solution and compound phase parameters. The present data base consists of thirteen elements: carbon, aluminum, silicon, titanium, chromium, manganese, iron, cobalt, nickel, copper, niobium, molybdenum and tungsten. This group will be expanded to sixteen by generating lattice stability values for boron, beryllium and phosphorus, and by analyzing the thermochemistry and binary phase diagrams between boron, beryllium and phosphorus and all other elements in the base. Additionally, thirty ternary systems consisting of elements in the base will be computed. The present thermochemistry/phase diagram analyses of lattice stability, solution and compound phase parameters will be coupled with parallel studies of the same quantities conducted along physical approaches based on quantum mechanical methods. Feedback and iteration between these methods will be used to obtain convergent values of these parameters. This is an extension of research previously funded by nsf Grant DMR76-08453A02. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

7.0006, AERODYNAMIC AND ELECTROMAGNETIC PROPERTIES OF PLASMAS

L. Cesari, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Mathematics, *Ann Arbor, Michigan* 48104 (DF046970; AFOSR-77-3211)

AF function - design of advanced aerospace vehicles. Deficiency -more critical design criteria requires more exact evaluation involving additional physical effects. Objective - increased understanding of satellite environment and structure. How work contributes - by developing solution techniques for problems in shock waves in fluids and plasmas, chemical reaction and diffusion, optical resonance, nonlinear elastic deformation and buckling, etc.

At present nonlinear problems are to a large extent treated individually although subclasses of such problems, their properties and their solution techniques are being characterized. Theoretical and numerical AF relevant examples in bifurcation aspects of three-dimensional viscous fluid flow - plasma, optical, water, and atmospheric waves and shock waves - reaction diffusion systems, nonlinear elasticity and buckling, etc., chosen for their importance in the development of a general theory, will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS

J.R. Walton, Texas A & M University, College Station Campus, School of Science, Dept. of Mathematics, *College Station, Texas* 77843 (DF048270; AFOSR-77-3290)

AF function - engineering intuition relating to tire impact on a runway, composite bonding, etc. Deficiency - mathematical techniques and solutions for power law viscoelastic materials. Objective - solution of two-dimensional time dependent contact and fracture problems. How work contributes - by suggestive examples, exhibiting and quantifying relevant non-intuitive effects.

Two problem areas in two-dimensional fracture of power law viscoelastic materials will be investigated: a steadily propagating, and semi-infinite crack at the interface of two bonded dissimilar power law half spaces, and stresses near the tip of an elastic interface edge crack. The Moment Conservation Integral Technique of Freund and Rice will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, MATHEMATICAL SIMULATION OF THE CARDIOPULMONARY SYSTEM

R.E. Collins, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DF041800; AFOSR-79-0123)

AF function - aircrew members operating high performance aircraft such as the F-15 and F-16 are exposed to increasing levels of rapid onset, long duration, repetitive g-forces. Data from USAFSAM and other research facilities indicate that the effects on the cardiopulmonary system may be the limiting factor in pilots' performance in air combat. Deficiency - a good physiological model of the cardiopulmonary system under g-stress is needed to provide human performance modelers the means to optimize combat tactics. Objective - the objective of this effort is to complete the development of a mathematical model of the cardiopulmonary system capable of predicting physiological responses to aerial combat maneuvering forces and to validate the model with simulated ACM G profiles. How research contributes - ultimately the complete model will be used to simulate cardiopulmonary response to ACM g-profiles. These studies will compare the predictions of this model to data obtained using the ear oximeter. As feedback and control mechanisms are added to the model, the model should provide total simulation of combined effects of varied g-profiles with g-suits, various breating maneuvers, positive pressure breathing and variations of oxygen supply.

The proposed research is the continued development and application of a mathematical model of the cardiopulmonary system. This model consists of a multi-chambered lung model coupled to a multi-chambered circulatory model specifically designed to simulate the response of human subjects to whole body accelerations. Programming and debugging of the pulmonary portion of the model have been completed. The circulatory portion of the model has been programmed, and debugged and all system parameters determined. Currently this circulatory model is being tested for a change in gravity and interfacing of the pulmonary and circulatory models has been initiated. It is expected to have the complete model, inclusinve of feedback systems, operational in the next year and ready for validations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SURVEILLANCE - STRUCTURE AND INTERACTIONS OF HIGHLY IONIZED ATOMS

S. Bashkin, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DN023294; N00014-75-C-0499)

This research provides data for developing models for understanding the properties of highly ionized atoms and interactions of these systems with other atomic species. Since these atomic species occur in high temperature plasmas and violent collisions, understanding their properties and interactions is important to the Navy from the standpoint of modeling nuclear weapons detonations with high temperature plasmas, studying solar activity with affects the ionosphere, and studying the effects of a nuclear detonation on the environment.

Lifetime determinations of 4P-4D transition in Cu and Zn isoelectronic sequences are being extended. Analysis of the lifetime data for the Navy is being finished. Research is continuing in illucidating mechanisms for vacancy production in heavy ion-atom collisions. Theoretical work on Coulomb ionization of atoms by projectiles with a larger charge than the atomic target

charge and on x-ray spectra emitted by ions moving through solids is continuing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0002, MODERN SPECTROSCOPY AND COLLISION STUDIES OF FUNDAMENTAL ATOMIC AND MOLECULAR SYSTEMS

W.H. Wing, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY79-15302)

Molecular ions and highly excited, or Rydberg, atoms are among the most difficult species to study spectroscopically because they are both fragile and highly active chemically. For the same reasons they play major roles in terrestrial plasmas and in the chemically active regions of the interstellar medium. The two- and three-body systems, the hydrogen molecular ion, hydrogen atom, and helium atom, the pivotal in the development of atomic theory. They may be used both to test the theory and to improve values of natural constants fundamental to metrology through comparison of experimental with theoretical spectra.

Continued ultrahigh-resolution spectroscopic research will be carried out, using recently-developed single- and multi-quantum laser-beam - particle-beam and microwave-optical methods, on the spectra of HD ion, other molecular ions, the helium atom, and the hydrogen atom. Ultrahigh-accuracy absolute HD ion transition frequencies will be measured. A new technique for terahertz-bandwidth, high-resolution, two-quantum submillimeter-wave spectroscopy will be explored. Fine structure of low- and high-angular momentum helium Rydberg states will be measured. Substate-resolved collisional excitation transfer among Rydberg levels of helium will be investigated in detail. Remeasurement of the Rydberg constant in frequency units will be attempted, using hydrogen-atom Rydberg states. (This research is a continuation, currently supported under NSF grant, PHY77-15217 A02.)

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, ELECTRONIC PROPERTIES OF HETEROJUNCTIONS

J.O. McCaldin, California Inst. of Technology, Graduate School, Dept. of Applied Physics, *1201 E. California Blvd., Pasadena, California* 91109 (DN675685; N00014-76-C-1068)

The performance and reliability of electron and optical devices for future Navy electronic systems requires better understanding and control of the properties at the interfaces between semiconductor materials. The structural and electronic properties of these interfaces or heterojunctions need further study to determine the factors which influence the fabrication of reliable devices and the analysis of possible classes of electron devices.

Theoretical tight binding calculations will be used to explore the electronic nature of semiconductor heterojunctions and superlattices. For heterojunctions, the relation between interface states and bulk states will be clarified. The mercury chalcogenide-cadmium chalcogenide heterojunction will be investigated in terms of a lattice matched Schottky barrier due to the semimetal nature of the mercury system. The modified structure will be investigated with regard to barrier formation and interface states. Defect and stoichiometry effects on Fermi level pinning will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, STUDY OF HETEROJUNCTION DISCONTINUITIES IN SEMICONDUCTORS

E.A. Kraut, Rockwell International Corp., Science Center, *1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (DN775015; N00014-76-C-1109)

Development of many new electron devices for Navy surveillance and communications electronics systems will require better understanding and control of heterojunctions in semiconductors. Theoretical and experimental studies of the electronic properties of semiconductor-semiconductor junctions will lead to new classes of devices and better understanding and control of devices already being studied by the DOD.

Combining a theoretical analysis of the valence band density of states for each component system of a gallium arsenide-germanium heterojunction, with experimental x-ray photoemission results, absolute values for the valence band edges are determined. Their difference gives the value for the valence band discontinuity across the heterojunction. Various elemental and compound semiconductor couples chosen from rows 4 and 5 of the periodic table will be grown as abrupt heterojunctions. Measurements of absolute valence band energies and valence band discontinuities at the junction will be studied systematically as a function of interface chemistry, ionicity, geometry and composition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, ATMOSPHERIC TRIATOMIC MOLECULAR STUDIES

A.C. Wahl, Science Applications Inc., *1200 Prospect St., P.O. Box 2351, La Jolla, California* 92037 (DF051720; F49620-78-C-0050)

AF function - this research contributes to RO 6.1, Nuclear Weapons Effects. Deficiency - the interpretation of emissions from the atmosphere following a nuclear burst requires a knowledge of the electronic transitions and oscillator strengths of triatomic molecules. Objective - the purpose of this research is to perform calculations to obtain the required information for H20, N20, N02, C02, and 03. Contribution -results are available for inclusion in nuclear weapons effects computer codes.

Calculation of vertical spectra and construction of adiabatic correlation diagrams will be done for the triatomics of atmospheric interest. Diffuse basis functions will be included to describe negative ions and Rydberg states. MCSCF/CI calculations will be extended to include portions of the virtual space. Minimum energy and adiabatic pathway calculations will be made for the reaction 0-plus and N2 yielding N0-plus and N. Ground state vibrational analyses of C02, 03 and N02 will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, TRANSIENT EVAPORATION OF IONIC CRYSTALS

Z. Munir, University of California, Davis Campus, School of Engineering, Dept. of Mechanical Engineering, *Davis, California* 95616 (DMR79-09020)

This grant is to continue fundamental studies on the mechanisms of transient evaporation of ionic semiconductors, such as cadmium sulfide and zinc oxide, particularly as vaporization relates to surface charge. The dependence of the transient behavior on surface charge will be examined in terms of crystallographic orientation, original stoichiometry (or doping) and temperature. Additionally, the effect of extrinsic doping on the transient evaporation rate will be undertaken. Isothermal rates will be measured utilizing torsion and microbalance techniques. Surface ledge spacing and height will be determined in a low energy electron diffraction (LEED) apparatus. These parameters will be examined as a function of the initial ledge spacing, the initial degree of nonstoichiometry, and the degree of undersaturation during evaporation. Relative changes in the point defect concentration accompanying evaporation will be determined from Hall Coefficient and electrical resistivity measurements.

The work is a continuation of research initiated under NSF grant DMR77-08472, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, THEORETICAL STUDY OF NONLINEAR AND COLLECTIVE EFFECTS IN UNSTABLE PLASMAS
B.D. Fried, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN524497; N00014-75-C-0476)

Conduct research on nonlinear and collective effects in unstable plasmas for naval applications to ballistic missile effects, atomic weapons effects, communications, and energy conversion systems. This work includes investigations of ponderomotive force effects to antenna structures immersed in plasmas, nonlinear evolution of electron beams driven by external DC electric fields, and the properties of a plasma with truncated distribution functions.

Theoretical and numerical studies consist of isolating specific nonlinear processes that give rise to large effects which can be observed in laboratory plasmas. These studies play the dual role of suggesting new nonlinear experiments as well as explaining the outcome of naval experiments in which previously unexpected nonlinear phenomena are often found. The salient results obtained by this approach are used to understand the complexities involved in plasma heating as well as in the interaction of intense radiation plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0008, ACTIVE STIMULATION OF AURORAL PLASMAS
A.Y. Wong, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN875505; N00014-78-C-0754)

The objectives are to develop a better understanding of the auroral phenomena that lead to disruption of naval communications through active experiments, and to investigate the possible generation of radio waves at VLF frequencies and below through modulation of the Earth's field aligned currents.

In order to develop a better understanding of the highly nonlinear and complex interaction between high power radio waves and the auroral ionosphere in the presence of field aligned currents, laboratory experiments are being planned which will scale as closely as possible to ionospheric conditions. The experiments will serve as a check on the theoretical models which are under development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, THEORY OF SOLIDS
W. Kohn, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR78-25005)

Research previously supported by DMR7682422.

Research in the theory of solids will be carried out. The main emphasis will be on surface phenomena, including: (a) dynamics of electrons near metal surfaces, especially the high density limit of the work function; (b) scattering of positrons from metal surfaces; and (c) implications of bulk phonon spectra.

Other subjects to be studied include the following: density-density response functions in inhomogeneous systems with applications to non-local energy corrections of density function 1 theory; a new formulation of local theory of electronic structure allowing the calculation of local properties of an extended system without having to deal with the entire system; and theoretical studies, related in part to ongoing experimental programs of optical systems, for efficient conversion of solar radiation into heat.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, THEORETICAL PARTICLE PHYSICS AND THEORY OF PHASE TRANSITIONS
M. Nauenberg, University of California, Santa Cruz Campus, Crown College, Dept. of Physics, *Santa Cruz, California* 95064 (PHY78-22253)

This work is in the field of theoretical physics, with emphasis on problems in statistical mechanics and elementary particle physics. In particle physics, the topics include the study of topological properties of the non-Abelian gauge theories, models of quark confinement in both lattice and continuum approximations, and phenomenology of hard proton scattering. In statistical mechanics, the renormalization group will be applied to various phase transitions, such as spin glass transitions which have not yet been fully understood. Finally, problems in high-energy astrophysics relating quantum field theory and general relativity will be pursued.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY76-18598A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, IR BACKGROUND MEASUREMENTS
D. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (DF582060; F19628-78-C-0164)

AF function - surveillance, target detection, discrimination and acquisition. Deficiency - lack of high-resolution spectral data of atmospheric background emission which reduces target to background contrast. Objective - obtain high-resolution IR spectral data of atmospheric background emission as a function of altitude, time of day and season - data which is needed for enhanced performance of present and future sensor systems used for target detection.

A 0.1 cm to the minus 1 resolution LIN-cooled interferometer and gondola package will be modified, such that the whole system will have elevation and azimuth pointing capability for down-looking as well as up-looking balloon measurements. This instrumentation will then be used to perform IR background emission measurements as indicated in objective. A 'cold' mirror assembly will be mounted as an integral part of the anti-frost system to allow for elevation and azimuth pointing and for downward looking. A bore-sighted camera will also be installed for downward looking for field of view monitoring in the spectral regions where the atmosphere is transparent.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0012, THEORETICAL LOW TEMPERATURE PHYSICS
P. Kumar, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR80-06311)

Theoretical research in low temperature physics will be carried out. The projects to be pursued will include superfluid helium-3, solid helium-3, and interface effects between liquid and solid helium-3.

In the superfluid case, the spin dynamics including relaxation effects will be analyzed, in order to interpret anomalous experimental results. In the solid case, the effect of magnetoacoustic coupling will be examined, and the spin wave spectrum and sound propagation will be studied, with the purpose of understanding the details of the ground state spin arrangement.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, OPTICAL PUMPING STUDIES OF COLLISIONAL INTERACTION
F.A. Franz, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DF026380; AFOSR-79-0031)

AF function - the Air Force has a specific interest in the development of an optically pumped nuclear gyroscope, which would be ideal for strapdown systems having an extremely high dynamic range, high g capabilities, and small size. Deficiency - past efforts to develop a functioning gyro have failed because too little is known of the fundamentals involved. Objective - in this research a series of experiments is being performed in which

optical pumping methods are being used to study the effect of collisional interactions in atomic vapors. Contribution - better knowledge of the fundamentals involved in collisional interactions in NMR gyros will be achieved.

Measurement of cross sections for collisional relaxation both in low and high magnetic fields are being made. The high magnetic field work in particular promises new information on the strength and character of the collisional interaction, the influence of nuclear spin, and the dependence of collisional selection rules on strength of magnetic field. The low magnetic field work gives information directly relevant to the understanding of relaxation processes in optically pumped frequency standards, lasers, magnetometers and gyroscopes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, DYNAMICAL SCALING IN NORMAL AND SUPERFLUID LIQUIDS

R.A. Ferrell, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DMR79-01172)

Research previously supported by DMR7414372.

Theoretical research on the critical dynamics of normal and superfluid liquids will be carried out. Particular emphasis will be placed on the lambda transition of liquid helium, in order to exploit recent developments on this problem. Further details of the light scattering spectra and critical region will be studied. A thorough exploration of the critical dynamics of the ordered state of helium will be undertaken. Also, some higher order calculations on the binary liquid problem will be completed, in order to interpret some of the data generated by the University of Maryland experimental phase transition group. Special attention will be given to the nature of spinodal decomposition in a two-component fluid.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, COMPOSITION AND ELECTRONIC STRUCTURE OF ALLOY SURFACES

R.L. Park, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR79-00323)

Research previously supported by DMR-7684576.

A study of metal and alloy surfaces using novel core level probes will be carried out to determine the interaction between the constituents of alloys in the surface region and surface energy effects and absorbed gas layers. Understanding the electronic structure of such complex systems requires surface probes that are capable of separately examining the electronic states of each constituent element. The basic tool in these studies is appearance potential spectroscopy, which measures the probability for inelastic electron scattering from core state electrons. In the past, appearance potential studies have focused on spectral features near the scattering thresholds, which are related to the conduction bond density of states. However, fine structure can be observed extending hundreds of electron volts above the thresholds. This structure, which is analogous to X-ray absorption fine structure, provides information on the bonding geometry in the surface region. The study will also involve more conventional probes such as low energy electron diffraction and Auger electron spectroscopy.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, SOLID-STATE PHYSICS STUDIES WITH POSITRONS

S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR79-26035)

Experimental research at Brandeis University involving the development and use of positron annihilation techniques for solid state physics experiments will be continued. The program consists of two parts: momentum density and Fermi surface measurements in metals and alloys, and surface studies with slow positron beams. The angular correlation of annihilation radiation (ACAR) from positrons injected into solids measures the electronic density in momentum space as sampled by the thermalized positrons. The analysis of the two-dimensional ACAR data yields Fermi surface of the metallic sample. We will improve and use our multiple detector cross-correlation apparatus to obtain two-dimensional ACAR data in metals and alloys. Measurements are outlined in disordered substitutional binary alloys, in high temperature superconductors, and in some ferromagnetic metals. Collaboration with several solid state theorists is involved. Experiments using the recently completed slow positron beam facility will be carried out. These involve the study of the interaction of slow positrons with well characterized surfaces. In particular, angle-resolved elastic and inelastic positron scattering and slow positron and positronium emission from surfaces will be investigated.

This is a continuation of research previously supported by NSF grant DMR 76-24376. This is the first year of a five-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, ELECTRONIC STATES IN DISORDERED MATERIALS

A. Bansil, Northeastern University, College of Arts & Sciences, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR79-02600)

The research to be performed will focus on the equilibrium electronic properties of disordered metals. The materials to be studied include noble and transition metal alloys and metallic glasses.

The disordered alloys will be investigated within the framework of the coherent potential (CPA) and the average t-matrix approximations (ATA), utilizing realistic muffin-tin potentials to represent the atoms. The question of calculating self-consistently charge densities and atomic potentials in transition and noble metal alloys will be studied. The extensions of the theory to obtain average momentum densities, measured by a Compton scattering or a positron annihilation experiment, will be taken up.

The theory will also be used to study the electronic spectrum of liquid metals and metallic glasses. The latter materials have many potential technological applications. In recent years a substantial body of experimental optical, photoemission, specific heat, magnetic susceptibility, Hall effect and residual resistivity data on liquid and amorphous metals has become available. The extent to which these data can be correlated within the present scheme will be investigated. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, A PARAMETRIC STUDY OF THE EMP INTERACTION WITH AN AIRCRAFT OVER A LOSSY GROUND PLANE

T.T. Crow, Mississippi State University, School of Arts & Sciences, Dept. of Physics, *102 Experiment Station Bldg., Mississippi State, Mississippi* 39762 (DF053110; AFOSR-78-3667)

AF function - a number of simulation facilities have been constructed to test the response of aircraft and missile to the nuclear EMP. In each of the existing facilities the aircraft must rest on a concrete pad which eliminates the possibility of testing the inflight mode response or the tests must be conducted as the aircraft flies by the simulator which in turn presents its own particular difficulties. Opportunity - a theoretical model is needed for the interpretation of the 'fly-by' test data as well as for the extrapolation of the test data from ground-based measurements to predict the inflight mode response. Objective - a determination of the aircraft skin current and charge when the aircraft is under illumination of nuclear EMP and in the ground alert mode. Contribution - this work will provide analytic

models for the determination of induced skin currents and charges by external electromagnetic pulses.

The dyadic Green's function for a lossy half space will be derived and the Green's function extended to the complex S plane. A SEM representation for the integral functions will be derived aiming toward a numerically efficient means of calculating the dyadic Green's function integral equations for a thin wire horizontal to a lossy half space and for perpendicular crossed wires over a lossy half space. Next, approximate analytic solutions and numerical solutions will be obtained for the wire currents.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, THE INTERACTIONS OF ENERGETIC PARTICLES WITH THE SOLAR WIND - A THEORETICAL STUDY

L.A. Fisk, University System of New Hampshire, University of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-08353)

This grant funds a broad-based program of theoretical studies into energetic-particle interactions with the solar wind. The work to be undertaken includes: (1) the extension of current numerical models for the solar modulation of galactic cosmic rays to include the effects of curvature and gradient drifts, (2) the use of solar and cosmic-ray data, and the above numerical model, to develop a more realistic model for the causes of solar-cycle variations in the galactic cosmic ray flux, and (3) the development of a more reliable theory for the propagation of low-rigidity particles. The overall aim is to understand the interaction of the sun with energetic particles as a function of the solar cycle.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0020, THEORETICAL PHYSICS

J.D. Bahcall, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (PHY79-19884)

Research will be performed in several areas of theoretical physics, including astrophysics, relativity, and particle physics. The astrophysics group will emphasize problems in stellar dynamics, including galaxy stability, the characteristics of disks, and the evolution of many-body systems, as well as studying aspects of X-ray sources, stellar evolution, the interstellar medium, and extragalactic phenomenology. Work will continue in the area of relativity including especially supergravity and classical fermion solutions. Some possibly related aspects of gauge field theory in particle physics will also be investigated.

This is the first four months of a forty-month grant, previous research supported under NSF grant PHY77-20612.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, MATERIAL SUPPORT TECHNOLOGY - CORRELATION, DISORDER, AND NOISE IN ELECTRONIC SYSTEMS - METAL-INSULATOR TRANSITIONS IN SEMICONDUCTORS

D.C. Licciardello, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (DN775758; N00014-77-C-0711)

The fundamental processes in non-crystalline systems determine the important electronic properties of a wide range of materials that are important for naval system applications, from glass to sophisticated electronic semiconducting devices. Unfortunately, many of these fundamental processes are not well understood. This program will address the electronic properties of these non-crystalline systems.

A program of basic research in non-crystalline solids will investigate their physical properties, including the temperature dependence.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0022, OPTICS OF SOLIDS (SURFACE-RELATED) AND EFFECT OF SURFACE ROUGHNESS OF MOS (16180-P)

J.L. Birman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Mathematics, *Convent Ave. & 138th St., New York, New York* 10031 (DA0G8958; DAAG29-79-G-0040)

To study optics of bounded gyrotropic media and the effect of interface roughness on conductivity in metal oxide-semiconductor structures. Relevance: The research is relevant to (1) work on metal oxide-semiconductor devices at ERADCOM, (2) understanding and improving the gyrotropic effect of the materials used in Pockel's readout optical modulator devices, (3) to possibly extremely fast response characteristics of 'enhanced photoemission' devices that use surface mode excitation.

Using a time-dependent formulation of the extinction theorem, attenuated total reflection and total internal reflection will be studied in a transient mode of excitation of surface modes. Using an inverse dielectric function formulation which includes spatially dispersive effects, the possible existence of increased gyrotropy (optical rotatory power) will be investigated. For the study of metal oxide-semiconductor systems, the 'method of perturbed boundary conditions' will be used to include the effect of surface roughness from the very beginning on the wave functions, the energy levels and the mobility.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0023, ELECTRODYNAMICAL AND FLUID DYNAMICAL PHENOMENA IN ASTROPHYSICS

E.A. Spiegel, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (PHY77-27086)

Research in theoretical astrophysics initiated under NSF grant PHY75-05660 A02 will be continued. Topics to be investigated include: Pulsar Electrodynamics; 1. The polarization of radio emission from pulsars; 2. High-energy pulsar radiation and double pulses; 3. Electron-positron creation in pulsar magnetospheres.

Fluid Dynamics; 1. The Maunder minimum; 2. Interaction of pulsation with convection; 3. Convection in the solar core.

Miscellaneous; 1. Explosive matter at neutron star surfaces; 2. Consequences of rapid solidification of dense stellar matter; 3. Line broadening in an expanding medium; 4. Collisionless shocks in supernova remnants.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, THEORETICAL STUDIES OF EFFECTS IN TETRAHEDRAL SEMICONDUCTORS

J.A. Van Vechten, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DF055210; F49620-79-C-0077)

AF function - this proposed research primarily falls in the 2.3 research objective which deal with forms of matter which possess the ability to generate, detect, process, control and otherwise usefully employ electromagnetic energy for military-related purposes. These include man-made artifacts which underlie most of the semiconductor devices, infrared detectors, electroacoustic elements, transducers, lasers, radiation resistant devices, non-linear optics, integrated optics and numerous other devices and components. Deficiency - new or improved materials are needed capable of serving as window materials in the 1-6 micron wavelength of chemical lasers and the 10.6 micron wavelength of water lasers. The chemical lasers require materials chemically inert to attacks of HF or DF. Particular research attention should be paid to the minimizing of absorbing inclusions,

the temperature variation of refractive index, optical absorption and other important materials parameters. Objective - 1) the identification, by means of simple estimates of thermochemical parameters and analysis of the thermal history of a given sample, of the chemical and structural nature of the defects that ought to be present in the given sample, and 2) the theoretical determination of the electric and optical properties of these expected defects for comparison with available experimental data. Contribution - this research is a part of a comprehensive program in radiation interaction with matter.

The PIs plan to continue their study of the behavior of dislocations. In addition to their interaction with light and with carriers, they are studying the effects of electric field, strain and impurities. They have in progress a study of the effect of various electrolytes and potentials upon the quality of Si wafers sawn from a boule. The investigators have found that a significant improvement in the depth and nature of potential can be detected. Now that the question of whether vacancies or self interstitials are the dominant native defect in Si, GaAs, etc. is settled, they will return to the program they intended to pursue before this controversy arose, namely, taking estimates of the heats of formation, of migration, and of kinetic factors, such as surface reconstruction, which affect the concentration of defects incorporated into the crystal during growth and high temperature processing. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, STATISTICAL MECHANICS OF THE LIQUID STATE

G. Stell, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (CHE79-00838)

This grant supports research under the Structural Chemistry and Thermodynamics Program for theoretical studies of the liquid state using statistical mechanical methods. Thermodynamic, structural, and transport properties characteristics of the liquid state and of its phase boundaries will be investigated. Four broad topics will be emphasized: (1) the structure and thermodynamic properties of ionic solutions with particular attention to the higher valence aqueous electrolyte regime, (2) the thermodynamic and dielectric effects of long-range forces in molecular liquids, (3) a general statistical mechanical investigation of polydisperse systems, and (4) the transport properties of liquid mixtures using the revised Enskog theory as a starting point.

This research is a continuation of that currently supported by Foundation Grant, DMR-7307580.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS

W.O. Doggett, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DF056980; AFOSR-80-0051)

AF function - the AF has requirements for the development of weapons effects simulators, new microwave sources for advanced radars and electronic countermeasures, and advanced weapons concepts. Deficiency - no laboratory device can realistically simulate the radiation environment of a nuclear weapon. No conventional accelerator can maintain accelerating fields of megavolts per centimeter over many meters. Radar systems are not available which can locate and provide images of remote satellites in high orbits around the earth. Objective - the objectives of this work are 1) to characterize and enhance collective ion acceleration in vaccuum diode geometries, 2) conduct an experimental investigation of the dielectric cathode guide phenomena to understand the basic mechanisms involved in the transport of relativistic electron beams, 3) experimentally determine the density and rotation rate profiles for a nonneutral electron beam propagating in an axial magnetic field in a conducting pipe, and 4) to develop techniques to focus relativistic electron beams into radii of the order of 0.1mm. Contribution - the beam focusing and dielectric cathode transport studies are important for the development of pellet fusion x-ray sources. The collective ion acceleration work contributes to the development of advanced concepts.

The collective ion acceleration research will emphasize the Luce vaccuum diode geometry and is aimed at determining the mechanism involved in the acceleration. Experiments will be conducted on the low impedance (7 ohm) Marx charge machine at NCSU. To characterize the dielectric guide cathode, optical techniques will be used to measure the break-down velocity. These include fiber optic light pipes coupled to photomultiplier tubes and image converter camera pictures. A laser scattering technique will be used to measure the electron and ion density and the temperatures in the diode plasma. A Q-switched ruby laser beam will be focused onto a small spot of diameter less than a millimeter and the scattered light will be collected and dispersed by a spectrometer into adjacent wavelength detection channels. The knowledge of these parameters in the diode plasma on a time-resolved basis should be useful in evaluating the collective ion acceleration mechanism. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0027, DEEP-LEVEL IMPURITIES IN SEMICONDUCTORS

J.S. Blakemore, Oregon Graduate Center, Graduate School, Dept. of Applied Physics & Electronic Science, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (DMR79-16454)

The proposed program seeks an improved understanding of deep-level impurities (those of large ionization energy) in semiconducting materials. Emphasis would be placed on deep-level states in the direct gap semiconductor GaAs, particularly for the 'semi-insulating' materials Cr-doped GaAs and Fe-doped InP. The program would seek to use information derived from electrical and optical types of measurement to deduce how charge is bound in space around a deep-level impurity atom or complex, and what this implies for the form of the local binding potential. Such a view of a deep-level impurity - as an object in real space - is useful for known impurity species, and could be of assistance in identification of some of the many unknown impurity species which manifest themselves in compound semiconductors. Towards that end, information available from published and other sources would be complemented by electrical, photoconductive, luminescent and optical measurements. This provides information about the energy spectra and reciprocal space properties that can be Fourier-transformed into an impurity description in real space.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, PULSED HOLOGRAPHY OF RAPIDLY MOVING DUST PARTICLES

K.M. Hagenbuch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DF058760; AFOSR-80-0197)

AF function - future missiles will use high energy propellants containing particles. Deficiency - incomplete understanding of the mechanisms of the two-phase flow and combustion losses in propulsion systems whose combustion products contain particles. Objective - to improve the resolution of double exposure holograms and to use those techniques to study particle velocity and number density. How work contributes - will provide improved means for understanding two-phase flow processes that produce flow losses, agglomeration, and impingement with chamber walls.

Single- and double-exposure holograms will be obtained for rapidly moving, dust containing flows. Particle velocities and number density will be determined by the identification of particles in double exposure holograms. Attempts will be made to improve resolution by image subtraction during the recording phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0029, SURFACE QUANTIZATION AND ELECTRON-ELECTRON INTERACTIONS

P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR79-13787)

The properties of quasi-two-dimensional electronic systems in inversion layers or accumulation layers in Metal-Oxide-Semiconductor (MOS) structures will be examined. The experimental transport studies will deal primarily with the two-dimensional electron gas with high electric fields imposed. This is a system in which one has a non-equilibrium distribution of carriers. Some new tilted surface experiments as well as effective mass measurements also will be carried out. The latter will start with studies of the conductivity in the presence of its surroundings and how the parameters affect the conductivity. Then the influence of periodic or random potentials and how they affect the electronic structure will be examined. Other experiments involving other two-dimensional systems (transition metal dichalcogenides) will be initiated. These studies are aimed at providing an improved understanding of the electronic structure and transport in mirostructures in the size regime between atomic and macroscopic.

This is a continuation of research previously supported by NSF grant DMR-7710218.

This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, IONOSPHERIC MODIFICATION EXPERIMENTS AT ARECIBO

W.E. Gordon, Rice University, George R. Brown School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (ATM79-09088)

The ionospheric modification experiments performed at Arecibo have led to significant developments in aeronomy, ionospheric physics and plasma physics. The variety of unexpected phenomena associated with the modification process has stimulated a great deal of theoretical work, especially in the field of nonlinear plasma physics. Of particular importance have been the so-called parametric instabilities which have applications to laser fusion research, and the thermal coupling processes which lead to a striated ionospheric plasma.

Using support provided here, Dr. Gordon will mount one major and two follow-up ionospheric modification experiments per year using the current facilities at Arecibo Observatory along with the auxiliary HF facility now under construction and a portable 50 MHz radar positioned on the island of Guadeloupe.

The problems of interest reflect the widening scope of the experimental capabilities at Arecibo. The following areas of research will be studied: 1. Parametric instabilities in the F region, their excitation and suppression. 2. The generation of meter scale field-aligned plasma striations and their relation to plasma instabilities. 3. The interaction of the HF wave with blanketing sporadic E and the implications of these observations on the nature of sporadic E.

The overall aim is to stimulate the ionosphere in order to further our understanding of plasma instabilities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0031, HYDROGEN SCATTER VELOCITY

E.S. Fry, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DN075562; N00014-80-C-0806)

The interaction of hydrogen with surfaces is basic information that is useful to naval applications of catalysis, fuel production, batteries, rocketry, spacecraft, etc.

The principal investigators will study the interaction of atomic hydrogen with various surfaces using a new technique of hydrogen velocity-resolved scattering.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0032, STUDY OF GRAVITATIONAL THEORY AND GENERAL RELATIVITY

R.A. Matzner, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (INT78-22553)

Physicists from the Center for Relativity at the University of Texas at Austin will be collaborating with counterparts at the Center for Nuclear Studies of the National Autonomous University of Mexico. These scientists will be working toward elaboration of mathematical models of general relativity in which solutions of the equations differ in some important details from the Einstein model. Favorable results would lead to important developments in our understanding of stellar phenomena and the cosmos.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0033, IONOSPHERIC WAVE-PARTICLE EFFECTS

D. Strickland, Science Applications Inc., *1710 Goodridge Dr., P.O. Box 1303, McLean, Virginia* 22102 (DN980217; N00014-79-C-0197)

To investigate the effects of ionospheric plasma wave-particle interactions on the transport of non-thermal electrons.

Develop plasma physics modules which treat wave-particle interactions and incorporate these modules into NRL's existing numerical code of electron transport and deposition in the ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0034, INTERACTING EXCITATIONS IN CONDENSED MATTER

J. Ruvalds, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-13167)

Research previously supported by DMR-72-02972.

Theoretical research on interacting excitations in various phases of condensed matter will be carried out. The following topics will be emphasized: (1) Quantum Liquids: The strong hybridization the He3 quasi particles with the phonon-roton branch in He3-He4 mixtures will be calculated. Also the effective He3-He4 coupling will be computed in search of the possible formation of a new superfluid phase in the mixtures. (2) Plasmon Excitations: Plasmon lifetimes in metals will be calculated and recent plasmon anomalies observed in electron loss measurements will be investigated. (3) Phonon Coupling and Phase Transitions: The connection between phonon coupling and certain structural phase instabilities will be considered with emphasis on metal hydrides which exhibit unusual superconducting properties. Of primary concern will be the role of an harmonicity in the phonon softening and its relation to the observed superconductivity at high temperatures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, ELECTRICAL CONDUCTIVITY OF SHOCK-COMPRESSED INSULATORS, II

G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF051190; AFOSR-78-3478)

AF function - Air Force studies of the effects of nuclear blasts are consistently plagued by problems of unwanted electrical conductivity in monitoring probes. Opportunity - mechanisms of conduction are not understood, and no rational basis for selecting better insulation is available. Objective-this research will define the role of ionic conduction in shock-induced conductivity in crystalline solids, investigate the role of electron excitation in shock induced conductivity in organic materials, and design a set of experiments for measuring shock-induced conductivity up to pressures of about 1 megabar. How work contributes - the results and understanding obtained through this research will lead to a set of recommendations for selection and

development of insulating materials for use under shock loading conditions.

A survey will be made of information on the electrical conductivity of insulators under shock conditions. An experimental arrangement will be designed for measuring electrical conductivity in both the Washington State University and AFWL contractor's (Sandia Labs) gas gun facilities. A series of shots will be made to determine the characteristic features of ionic conduction in a shock wave, and the relationship of basic mechanisms to the development of insulators for use at very high shock pressures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, RESPONSES OF COMMERCIAL FAMILY FARMERS TO URBAN DEVELOPMENT - DOCTORAL DISSERTATION RESEARCH

F.J. Aaron, Rutgers the State University of New Jersey, New Brunswick Campus, Livingston College, Dept. of Anthropology, *New Brunswick, New Jersey* 08903 (BNS80-20833)

Every year several million acres of agricultural land in the United States are converted to non-agricultural uses. Pressure for change in agricultural land use is particularly strong in rural-urban fringes of metropolitan counties. The study investigates the problems generated by urban development and responses to them by commercial vegetable family farmers. It examines: 1) farmers; particular urban development situations according to category of land use and scale of development; 2) the social, political, and environmental problems generated by the situations; 3) three categories of responses including farm management, information interactions with community members, and participation in local political affairs; 4) the features of problems and responses, and the relationships betweem them; 5) demographic and life cycle characteristics of farmers; and 6) the effectiveness of responses. Participant observation, intensive interviews, and a semi-structured interview schedule are used with data collected from aerial photographs and local records. Statistical techniques will be used to analyze associations between specified variables. The sample consists of 62 farm households located in northwestern Burlington County, New Jersey. The study will contribute to a better understanding of the range of urban development situations, the effects of them on people, and the nature of people's ability to change in response to problems they experience. It will also provide political leaders, planners, and others with a sounder, more realistic basis for making public policy affecting farmers and land use.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Behavioral & Neural Sciences

9.0002, CAPACITY BUILDING, TECHNICAL ASSISANCE, AND TRAINING FOR LOCAL GOVERNMENTS

B. Miller, State Municipal League, *214 E. Capitol Ave., Pierre, South Dakota* 57501 (79SD05C 04)

NARRATIVE DESCRIPTION: The South Dakota Municipal League plans to provide technical assistance and training to develop the risk management capability of municipal officials. A series of seminars will be given on risk management and an insurance manual will be developed for the municipalities. A wide variety of training will be delivered in areas such as election management, general management for airport managers and management of the municipal corporation. Technical assistance will continue to be provided in areas of need and concern based on the requests from the technical assistance hotline. The Municipal League will update a handbook for municipal officials which is the most used source of management information available to local officials. The primary function of the handbook is to develop the capacity and increase the productivity of local officials.

SUPPORTED BY U.S. Office of Personnel Management, Office of Iptergov. Personnel Programs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STUDIES OF POLARIZATION IN ASTRONOMICAL OBJECTS

J.R. Angel, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-22714)

The research to be carried out under this grant will be concerned with studies of the optical polarization found in several different kinds of astronomical objects. Most of the objects to be studied are those which emit polarized light such as white dwarf stars and quasars. The program of research will also include development of a fully automated polarimeter. Specific areas of research will be: (1) Magnetic white dwarf stars. There will be an attempt to identify features in the spectra of these stars. These white dwarf stars have magnetic fields 100 million times greater than the magnetic field of the Earth. The origin of this magnetic field will be investigated. (2) AM Hercules stars. There are three white dwarf stars which exhibit extreme circular polarization, and these objects are unique. These stars are in binary systems and it appears that mass is falling onto the surface of the white dwarf star. The nature of this mass flow near the surface star will be studied by recently developed high-speed, two color polarimetry. (3) Active galactic nuclei. The polarization properties of quasars, Seyfert galaxies and BL Lacertae objects will be studied. (4) Maps. A survey will be made of the types of polarization found in various types of galaxies. The distribution of dust and magnetic fields in galaxies will be examined. An attempt will be made to identify polarized synchrotron radiation in radio galaxies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, RENEWED SYNOPTIC OBSERVATIONS AND RESEARCH ON BASIC PROPERTIES OF THE SOLAR CYCLE

S.F. Martin, California State University & Colleges, California State University, Northridge Campus, School of Science & Mathematics, Dept. of Physics & Astronomy, *18111 Nordhoff St., Northridge, California* 91324 (ATM80-00519)

This grant supports an inter-observatory program of solar cycle research to be conducted at the Mt. Wilson, San Fernando and Big Bear solar observatories in southern California. This work is aimed at the study of both the individual and collective evolution of active centers over the solar cycle. This necessitates the investigation of aspects of the evolution of individual active centers that have not yet been thoroughly documented such as the very earliest stages of magnetic flux input, the very late stages including the formation and eruption of quiescent prominences, and the interactions of adjacent and consecutively developing active centers. Secondly and concurrently, the investigators will study how the characteristic patterns of active region evolution collectively change over the solar cycle. An effort will be made to identify the beginning of the next solar cycle which may already be detectable in the form of ephemeral active regions at high latitudes during the present solar maximum.

Aside from the research objectives the grant will also support the production of some synoptic data which will be invaluable during the Solar Maximum Year (1979-1981). The overall aim is to understand solar activity and its variability.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0003, SOLAR ACTIVE REGION STUDY
P.E. Argo, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN987538)

Investigate processes involved in solar active region growth and energy release (flares) with the goal in improving solar flare prediction. Acquire daily radio maps of the solar disc at 0.86 cm and 2.0 cm during the peak of the present solar cycle.

The La Posta 18.3 m antenna will be operated on a daily patrol mode, with emphasis made on following the time variations of events. A contract will be made with the Stanford University Institute for plasma research (Prof P. Sturrock) under the Director of Navy Laboratories Program for Joint Study between naval laboratories and universities. The institute will consider various flare models to see if any can provide the mechanism for periodic emission in either or both the microwave and x-ray parts of the electromagnetic spectrum.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

10.0004, RADIO ASTRONOMICAL STUDIES
W.J. Welch, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-21037)

Detailed observations of molecules in the galaxy will be continued with the millimeter wave interferometer. Studies will be made of carbon monoxide, water vapor, methanol and other molecular clouds in interstellar space. Measuring the molecular line radiation provides the only way to probe the internal conditions of the cool, dark clouds in which stars are forming.

Observations will also be made of planets. The temperature and general characteristics of the surface of many planetary objects, such as the rings of Saturn will be determined.

The highly energetic quasars will be the target of study as well. The short millimeter wavelengths penetrate much closer to the as yet unexplained energy source giving hope that these observations can better define this prodigious energy source.

The interferometer will continue to be upgraded with new receivers, a new control computer, and better and more efficient data handling equipment.

The 85-foot telescope, which works in a nearly automatic mode, will be used as one station in the intercontinental Very Long Baseline Interferometry network. Longer term surveys of the hydrogen gas in our galaxy is providing insight into the way the nearby gas in our own galaxy behaves. These projects will be continued.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, PARALLAXES OF NORTHERN AND SOUTHERN STARS
A.R. Upgren, Wesleyan University, School of Science in Society, Dept. of Astronomy, *Middleton, Connecticut* 06457 (AST78-19007)

All methods for the determination of cosmic distances outside the solar system ultimately depend on trigonometric parallaxes of stars. This fundamental method is of such importance for the calibration of the distance to all objects in the Universe that its precision must be evaluated most carefully. Such parallaxes cannot be determined except over a number of years of careful observation. This program will continue analysis of the systematic and accidental errors of past parallaxes, and determine new ones as necessary to assist in this endeavor.

A systematic difference appears to exist between the stellar parallaxes observed in the Northern and Southern Hemispheres. It amounts to 0.005 plus or minus 0.001 but its cause is unknown. Since the latitudes of the northern and southern observatories differ by more than 60 degrees, an astrometric telescope located near the Equator would be helpful in resolving the difference and identifying its cause. The new 65-cm refractor now in operation near Merida, Venezuela at latitude 8 degrees 48'N will be used to make parallax observations which could resolve the difference. In addition, parallaxes of some stars of individual interest will be observed there, mostly at deep southern declinations where no precise parallaxes are presently available. Studies on the origin and nature of existing differences between observations are already in progress and form a part of this program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0006, SUPPORT OF LUNAR AND PLANETARY INSTITUTE
M. Callahan, U.S. National Aeronautics & Space Admin., Office of Procurement, Headquarters Contracts & Grants Div., *600 Independence Ave. SW, Washington, District of Columbia* 20546 (DPP79-19075)

The National Aeronautics and Space Administration will provide for advice to the National Science Foundation on the collecting, curation, distribution, and scientific research on Antarctic meteorites. The basis of this advice will be provided by the Lunar and Planetary Institute. This interagency transfer of funds will cover the expenses on the part of the LPI of obtaining this advice. The LPI may seek assistance from the scientific community through an LPI committee, the Meteorite Working Group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

10.0007, A FINDING LIST FOR OBSERVERS OF CLOSE BINARIES (5TH EDITION)
F.B. Wood, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Astronomy & Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-07507 A01)

Support is for a new edition of the Finding List for Observers of Eclipsing Variable Stars; the 1963 edition of which has been an anachronism for more than 5 years. The editors contemplate a substantial broadening of the content of the Finding List so that it will more properly refer to close binaries, rather than only eclipsing variables. The source materials for the compilation are kept up to date at the University of Florida where the revision will be prepared. Camera-ready copy and the concomitant writing of the Finding List contents on magnetic tape will be undertaken for early publication and wide distribution.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0008, THE PROCESSES OF 'SCIENTIFIC REVOLUTION' IN SOLAR, LUNAR, AND PLANETARY ASTRONOMY
C.A. Wilson, St. Johns College, Graduate School, *Annapolis, Maryland* 21404 (SES80-08591)

Professor Wilson is studying solar, lunar, planetary, and cometary astronomy during the period 1630-1680. A major concern will be to trace the influence of Jeremiah Horrocks, both with respect to ideas and parameters, through the writings of Jeremy Shakerley to those of Thomas Street. Also, he plans to study Boulliau's correspondence, with a view to obtaining further insight into his astronomical ideas. Specific comparisons and histories will be prepared with respect to: (1) solar parallax, refraction, and the obliquity of the ecliptic; (2) calculative procedures for generating true anomalies from mean anomalies, and for determining aphelion, eccentricity, and mean longitude at epoch from observed heliocentric longitudes; (3) planetary parameters as compared with present-day theoretical values for the 17th century; (4) awareness of the inequalities in mean motion of Jupiter and Saturn; (5) use of Kepler's third law to obtain mean solar distances from periods; (6) the equation of time; (7) lunar theory; and (8) cometary theory. By means of a general overview supported by these specific comparisons and histories, he will seek to delineate the main features of astronomy as it existed and developed during the century and a quarter following the appearance of Kepler's Rudolphine Tables.

The study will not only contribute to the history of astronomy but will help to clarify the process by which the great Scientific Revolution came about.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Sciences

10.0009, NAVIGATION - TWO-COLOR REFRACTOMETER

D.G. Currie, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775533; N00014-79-C-0931)

The object of this work unit is to develop a new astronomical technique namely two-color refractometry which will directly measure the atmospheric refraction induced deviation in the apparent position of stars thereby allowing better stellar positions to be obtained and/or the amount of atmosphere through which the star light passes to be determined. These techniques are important to the Navy for stellar navigation and guidance.

This experiment involves the measurement of the apparent position of a star at two widely separated wavelengths thereby permitting one to use the difference in apparent position to determine the total effect of the atmosphere on the trajectory of light coming from a star. Data will be taken on the precision and accuracy of this technique.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

10.0010, SOLAR FLARE ACTIVITY (DA0F3006)

F.H. Reder, U.S. Dept. of Defense, Army, Communications Research & Development Command, Center for Communications Systems, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0G2713)

A. Compare results of last year's solar activity analysis for entire previous solar cycle with results of analysis of activity during first half of current solar cycle. While the current cycle is, as predicted, much stronger with respect to sunspot numbers and steady radiation output, it has up-to-now been weak with respect to abrupt flare activity. This raises the following question to be studied: has total (steady plus abrupt) radiation output only an eleven-year cycle which is composed of two out-of-phase 22-year cycles, one for steady radiation and the other for eruptive radiation? B. Study possibility that X-ray flare behavior has features indicative of following proton emission causing polar communication blackout. C. Study statistical behavior of X-ray flares for possibilities to predict near-future flare activity from recent activity.

Utilize published X-ray and proton flare fluxes, as well as locally available VLF phase anomalies caused by flares as basis for statistical studies. Compare sunspot numbers with monthly sums of x-fluxes for both solar cycles.

SUPPORTED BY U.S. Dept. of Defense, Communications Research & Development Command, Center for Communications Systems

10.0011, RAPID OPTICAL VARIATIONS FROM COMPACT STARS

R.E. Nather, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST79-06340)

This grant will provide support for observational studies of rapid optical variations of compact stars: white dwarf stars, neutron stars, and black holes. The work will concentrate primarily on the rapid variations associated with white dwarf stars, both the single white dwarfs and those in cataclysmic variables (the novae and related stars). The single white dwarf stars show variations in their luminosity because they are pulsating stars. Studies of these stars will include searching for new variable stars and measuring accurate periods and period changes of the pulsations. There will be studies of the rapid coherent oscillations of the white dwarf stars in the cataclysmic variables. There will be studies of the rapid flickering and quasi-periodic oscillations from the disk of material (accretion disk) surrounding the white dwarf. There will be measurements of the orbital radial velocity curves of these close binary systems, and there will be measurements of the profiles and changes in the profiles of the spectral emission lines coming from the accretion disk.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0012, GALACTIC ABUNDANCES OF THE CHEMICAL ELEMENTS

P.A. Vanden Bout, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-623)

Optical and radio spectroscopic studies have been made of a variety of interstellar molecules to determine molecular isotopic abundance ratios and to measure the effect that interstellar chemistry has in altering these ratios from that of the nuclei themselves. Observations of HNC, DNC, and HN13C have confirmed the temperature dependence of the fractionation of deuterium into DNC that is predicted by a gas-phase model of interstellar chemistry. Optical observations of CH ion have yielded 12CH ion/13CH ion ratios for three interstellar clouds. The mean value of 69 is in agreement with ratio observations of other molecules. To test whether the interstellar chemistry can produce dimers a search was made for a radio frequency line of (CO)2 with negative results. The (CO2/CO) ratio is less than 1%. The carrier of the interstellar dissuse bands is a problem of longstanding. A search of the relatively unexplored 6500-8900 A region yielded several new bands.

SUPPORTED BY Robert A. Welch Foundation

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N81-28047# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

GENERAL AVIATION AND NATIONAL POLICY

R. E. Caves Feb. 1980 71 p refs

(TT-8001; ISSN-0140-9751) Avail: NTIS HC A04/MF A01

General aviation in the United Kingdom is subjected to a loosely structured multicriteria assessment. The assessment process is an algorithm for testing the value of including a specified mode in normative transport planning. The mutually supportive value of the mode and the transport planning framework is shown. It is suggested that discrete accessibility measures are the best means of formulating objectives for the normative framework, within which each mode would perform those operations to which it is best suited. Author (ESA)

N81-28048*# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Technical Information Panel.

THE PRODUCTION OF THE AGARD MULTILINGUAL AERONAUTICAL DICTIONARY USING COMPUTER TECHNIQUES

Van A. Wente (NASA, Washington, D.C.), J. C. Kirschbaum (InterAmerica Research Associates, Rosslyn, Va.), and J. H. Kuney (Informatics Information Systems Co., Rockville, Md.) Apr. 1981 43 p AGARD Multilingual Aeronautical Dictionary previously announced as N80-30272.

(NASA-TM-82344; AGARD-R-684; ISBN-92-835-1384-3) Avail: NTIS HC A03/MF A01 CSCL 01B

The AGARD Multilingual Aeronautical Dictionary (MAD) contained 7,300 technical terms defined in English but also translated into nine other languages. The preparation work was performed by some 250 scientists and engineers who were members of AGARD and involved the translation skills of staff in many of the NATO nations. Nearly all the compilation and setting work for the book was done by computer and automatic photo-composition. The purpose of this publication is to record how the task was approached in terms of management planning. T.M.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-28049 Purdue Univ., Lafayette, Ind.

THE THEORETICAL PERFORMANCE OF HIGH EFFICIENCY PROPELLERS Ph.D. Thesis

Li Ko Chang 1980 163 p

Avail: Univ. Microfilms Order No. 8113653

The vortex lattice method is used to analyze the performance of propellers, and techniques of numerical optimization are devised to determine the optimum propeller blade shapes. Results are given for NASA SR-1, SR-2, SR-3, NACA 109622, and CESSNA 172 propellers. Comparison of the predicted power coefficients and the experimental results show good agreement at different advance ratios j. The ideal efficiency shows good agreement for a two blade propeller except that a slight under-estimate of the induced effect causes a slight over estimate of the ideal efficiency. A propeller proplet, which is a small airfoil section mounted at the tip, is investigated using the vortex lattice method. The efficiency improvement is 2% - 6.8% depending upon the propeller blade employed. A cant angle Beta sub 2 of the proplet controls the load distribution. Optimum condition can be approached by assigning a negative value of Beta sub w (toed out proplet). A linear function between the percentage of improvement in efficiency and proplet height is found to be within twice the proplet height boundary. Dissert. Abstr.

N81-28050 Purdue Univ., Lafayette, Ind.

AEROELASTIC STABILITY AND TIME RESPONSE ANALYSIS OF CONVENTIONAL AND SUPERCRITICAL AIRFOILS IN TRANSONIC FLOW BY TIME INTEGRATION METHOD Ph.D. Thesis

P. Guruswamy 1980 261 p

Avail: Univ. Microfilms Order No. 8113693

Computer based numerical procedures developed for aeroelastic stability (flutter) and response analysis of conventional and supercritical airfoils in transonic flow by time integration method are described. Airfoils are assumed to be oscillating in two dimensional, small disturbance and inviscid flows with low frequencies. Aerodynamic computations are carried out by finite difference methods with the use of transonic computer code LTRAN2. Both indicial and time integration methods are employed for obtaining unsteady coefficients. Aeroelastic equations of motion for the flutter and response analysis are formulated by using the strip theory. Equations are derived for two degrees of freedom system of airfoil, plunging and pitching. Four aeroelastic parameters considered are: airfoil-air mass ratio; plunge to pitch frequency ratio; position of mass center; and position of elastic axis. The flutter solution is obtained by U-g method by solving an eigenvalue equation. Time response solution is obtained by simultaneously integrating aerodynamic and structural equations of motion by time marching direct integration method.

Dissert. Abstr.

N81-28051 Iowa Univ., Iowa City.

MEAN FLOW PAST CIRCULAR CYLINDERS Ph.D. Thesis

Ismail Celik 1980 172 p

Avail: Univ. Microfilms Order No. 8114243

Mean pressure distributions on a circular cylinder were measured over a Reynolds number range of 100,000 to 570,000 with trip wires. The mean key parameters obtained from the pressure distributions were compared with other experimental data and the possibility of a Re independent regime was examined. The integral parameters and the shin friction coefficient were obtained from the velocity profiles. The results were analyzed to study the influence of the boundary layers on the overall flow.

The Cebec-Smith boundary layer calculation method was tested. The relative influence of the curvature and low Re effects were studied. A two parameter potential flow model of the real separated flow was developed. This model takes into account the influence of the wake via a pair of vortex sheets of constant strength to represent the thin, free shear layers. The boundary layer displacement effect on the external potential flow was also incorporated in the model. Finally, the boundary layer calculation method and the potential flow model were used iteratively to predict all the properties of the mean flow past circular cylinders. Dissert. Abstr.

N81-28052*# National Aeronautics and Space Administration, Washington, D. C.

REDUCTION OF PROFILE DRAG BY BLOWING OUT THROUGH PEG HOLES IN AREAS OF STREAMLINE SEPARATION BUBBLES

K. H. Horstmann and A. Quast Jul. 1981 19 p Transl. into ENGLISH of conf. paper DGLR-80-103 p 1-18 Presented at Symp. on Aerodynamischen Widerstand (Cologne), 25-26 Nov. 1980 Original language document was announced as A81-19392 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76603; DGLR-80-103) Avail: NTIS HC A02/MF A01 CSCL 01A

Streamline separation bubbles on aircraft profiles and fuselages were investigated. The additional drag was examined in relation to increased angle of incidence and unusually high wall sheer stress. A reduction of the separation bubble and a decrease in drag is obtained with pneumatic turbulators that blow ram air out of 0.6 mm pilot tubes at a distance of 16 mm. The pneumatic models are implemented at various positions and are found to be effective after the position of separation. E.A.K.

N81-28053*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD-AIR PERFORMANCE OF COMPRESSOR-DRIVE TURBINE OF DEPARTMENT OF ENERGY UPGRADED AUTOMOBILE GAS TURBINE ENGINE. 1: VOLUTE-MANIFOLD AND STATOR PERFORMANCE

Richard J. Roelke and Jeffrey E. Haas (Army Aviation Research and Development Command) Jun. 1981 17 p refs (Contract EC-77-A-31-1011)
(NASA-TM-82682; DOE/NASA/1011-34; E-572; AVRADCOM-TR-80-C-20) Avail: NTIS HC A02/MF A01 CSCL 01A

The aerodynamic performance of the inlet manifold and stator assembly of the compressor drive turbine was experimentally determined with cold air as the working fluid. The investigation included measurements of mass flow and stator-exit fluid torque as well as radial surveys of total pressure and flow angle at the stator inlet and annulus surveys of total pressure and flow angle at the stator exit. The stator-exit aftermixed flow conditions and overall stator efficiency were obtained and compared with their design values and the experimental results from three other stators. In addition, an analysis was made to determine the constituent aerodynamic losses that made up the stator kinetic energy loss. Author

N81-28054*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME ASPECTS OF CALCULATING FLOWS ABOUT THREE-DIMENSIONAL SUBSONIC INLETS

H. C. Kao 1981 20 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE, and ASME
(NASA-TM-82678; E-941) Avail: NTIS HC A02/MF A01 CSCL 01A

Based on the potential flow model, computations were carried out for various three-dimensional inlet models. Some of these calculated results are presented in the forms of surface static pressure, flow angularity, surface flow pattern, and inlet flow field. Comparisons with experimental data are also made. M.G.

N81-28055*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNPOWERED AERODYNAMIC CHARACTERISTICS OF A 15-PERCENT SCALE MODEL OF A TWIN-ENGINE COMMUTER AIRCRAFT

Daniel G. Morgan, Thomas L. Galloway, and Bruno J. Gambucci (Kendan Associates) Jul. 1981 74 p
(NASA-TM-81284; A-8552) Avail: NTIS HC A04/MF A01 CSCL 01A

An experimental investigation was conducted in the Ames 12-Foot Pressure Wind Tunnel to determine the unpowered aerodynamic characteristics of a 15-percent-scale model of a twin-engine commuter aircraft. Model longitudinal aerodynamic characteristics were examined at discrete flap deflections for various angle-of-attack and wind-tunnel-velocity ranges with the empennage on and off. Data are presented for the basic model configuration consisting of the fuselage, wing, basic wing leading edge, double slotted flaps, midengine nacelles, and empennage. Other configurations tested include a particle-span drooped leading edge (dropped outboard of the engine nacelles), a full-span drooped leading edge, low- and high-mounted engine nacelles, and a single-slotted flap. An evaluation was made of the model mounting system by comparing data obtained with the model mounted conventionally on the wind-tunnel model-support struts and the model inverted. Author

N81-28056*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE INFLUENCE OF UNSTEADY AERODYNAMICS ON HINGELESS ROTOR GROUND RESONANCE

Wayne Johnson Jul. 1981 47 p refs
(NASA-TM-81302; A-8635; USAAVRADCOM-TR-81-B-16) Avail: NTIS HC A03/MF A01 CSCL 01A

Calculations of the model frequency and damping for a hingeless rotor on a gimballed support in hover are compared with measured results for two figurations (differing in blade flap stiffness). Good correlation is obtained when an inflow dynamics model is used to account for the influence of the unsteady aerodynamics. The effect of the unsteady aerodynamics is significant for this rotor system. The inflow dynamics model introduces additional states corresponding to perturbations of the wake-induced velocity at the rotor disk. The calculations confirm the experimental observation that the inflow mode introduced by these additional states is measurable for one configuration but not for the other. Author

N81-28057# Arizona Univ., Tucson. Coll. of Engineering.

UNSTEADY TRANSONIC FLOWS: TIME-LINEARIZD CALCULATIONS

A. Richard Seebass and K.-Y. Fung Oct. 1980 12 p refs
(Contract N00014-76-C-0182; Grant AF-AFOSR-29541-76) (TFD-80-03) Avail: NTIS HC A02/MF A01

The flow is linearized about an experimentally measured or numerically calculated steady state, as represented by a given pressure distribution. For a given mode of motion, the amplitudes and phase lags of the lift and moment coefficients at a given reduced frequency are found by superposition from an indicial response. The computational effort is reduced by treating shock waves as discontinuities, and by applying the correct linear far-field behavior. A novel method of modeling the indicial response provides an analytical formula for the dependence of the amplitude and phase lag on the reduced frequency. T.M.

N81-28058*# Arizona Univ., Tucson. Coll. of Engineering.

SHOCK-FREE CONFIGURATIONS IN TWO-AND THREE-DIMENSIONAL TRANSONIC FLOW

A. Richard Seebass May 1981 21 p refs Presented at the MRC Symp. on Transonic, Shock and Multi-dimensional Flows, Madison, Wis., 13-15 May 1981 Sponsored by NASA, AFOSR, and ONR
(NASA-CR-164595; TFD-81-04) Avail: NTIS HC A02/MF A01 CSCL 01A

Efforts to replace Sobieczky's complicated analog computations of solutions to the hodograph equations by a fast elliptic solver in order to generate shock-free airfoil designs more effectively are described. The indirect design of airfoil and wing shapes that are free from shock waves even though the local flow velocity exceeds the speed of sound is described. The problem of finding an airfoil in two dimensional, irrotational flow that has a prescribed pressure distribution is as addressed. Sobieczky's suggestion to use a fictitious gas for finding shock-free airfoils

directly in the physical plane was the basis for a more efficient procedure for achieving the same end. A.R.H.

N81-28059# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.

THE PROBLEM: INSTANTANEOUSLY EFFECTING CONTROLLED BALLOON-SYSTEM DESCENT FROM HIGH ALTITUDE Final Report

James F. Dwyer 11 Sep. 1980 37 p refs
(AF Proj. 7659)
(AD-A100255; AFGL-TR-80-0277; AFGL-IP-291) Avail: NTIS HC A03/MF A01 CSCL 01/3

The need for a technique of instantaneously effect controlled balloon-system descent from high altitude prompted the development efforts reported herein. The background, the approach, test flight data, and the technical problems that frustrated the successful development of the desired technique are included. A simplified model of the shape of a partially full balloon is presented (a model that should also approximate the dimensions of subpressure shapes). Some heretofore unpublished information on apex valve characteristics and subpressure effects are included together with recommendations for any future work of this problem. Significant supplementary findings and historical perspectives are noted. Author (GRA)

N81-28060# Naval Postgraduate School, Monterey, Calif.

FLOW CONTROL ABOUT AN AIRBORNE LASER TURRET M.S. Thesis

James Robert Schonberger Dec. 1980 65 p refs
(AD-A100110; NPS-67-80-018) Avail: NTIS HC A04/MF A01 CSCL 20/4

A high-energy laser system inflicts damage on a target by radiating large amounts of thermal energy onto a small area. Airflow about the laser turret housed on top of an aircraft is unsteady, and causes problems in beam control. These problems are jitter, which is vibration of the laser beam, and optical path distortions. The theory of flow around a cylinder and around a sphere was examined, and several airflow control techniques were investigated as possible means of suppressing the unsteadiness of the flow. A fairing and turret-base suction apparatus was selected, and was experimentally tested in a wind tunnel. During the course of the experiment, several parameters were varied, as follows: blower flow rate, spacing between turret and fairing nose piece, and flow rate in five separate ducts. Results of the tests utilizing the tapered symmetric nose piece indicate that the fairing and base-suction technique eliminates the unsteadiness. Further research and testing are required to develop this technique for actual use on aircraft. Author (GRA)

N81-28061# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.

HIGH SPEED SMOKE FLOW VISUALIZATION Final Report, Sep. 1979 - Oct. 1980

Stephen M. Batill, Robert C. Nelson, and Thomas J. Mueller Mar. 1981 120 p refs
(Contract F33615-79-C-3034; AF Proj. 2703)
(AD-A100333; AFWAL-TR-81-3002) Avail: NTIS HC A06/MF A01 CSCL 20/4

Dr. V. P. Goddard demonstrated that it was possible to use smoke flow visualization techniques, which had previously been considered the tools of the low speed aerodynamicist, in high speed and supersonic flows. This report documents a study to evaluate the techniques used by Goddard and to establish design criteria for a large high speed flow visualization facility. Included are discussions of the existing facilities at the University of Notre Dame, studies of the wind tunnel flow field and methods for smoke data acquisition. Author (GRA)

N81-28062# California Univ., Berkeley.

VISCOUS-INVISCID INTERACTION IN TRANSONIC FLOW Ph.D. Thesis Interim Report

Laurence Byron Wigton Jun. 1981 123 p refs
(Grant AF-AFOSR-0230-80; AF Proj. 2307)
(AD-A101125; AFOSR-81-0538TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

The aim of this thesis is to couple an inviscid two dimensional steady transonic flow calculation with a boundary layer calculation. This interaction is especially important in transonic problems since the boundary layer has a significant effect on the inviscid portion of the flow. Here, the inviscid solution is obtained by an algorithm developed for the full potential equation by Holst and Ballhaus while the attached and separated turbulent boundary layer calculations are performed by Green's lag entrainment method. Guided by a model problem suggested by Le Balleur, a viscous-inviscid coupling algorithm is developed. Theoretical analysis indicates that it coverages rapidly for attached flows and also performs well for separated flows. These conclusions are confirmed through a series of challenging transonic calculations involving both attached and separated flows. The coupling algorithm is remarkably stable and allows computation of coupled viscous-inviscid flows within times required to perform the inviscid calculations by themselves. Author (GRA)

N81-28063# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Unternehmensbereich.

OPTIMIZATION OF PROFILES FOR TRANSONIC FLOW BY MEANS OF A METHOD OF FINITE ELEMENTS AND CHARACTERISTICS Final Report

Albrecht Eberle Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 60 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-018; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

An airfoil design method which makes possible direct calculation of supercritical profiles from normal profiles is presented. Exact transonic profile design methods to date were all based on hodograph methods. The input, in the form of the profile shape in the velocity plane requires considerable experience on the part of the user. In contrast to this an optimization method is proposed. This allows shock free profiles to be developed from a given input profile at fixed flow conditions by means of small contour changes. After showing the applicability of the method to the flow around profiles, application to the optimization of supercritical wings is evident since the method can generally be used for the treatment of three dimensional flows.
Author (ESA)

N81-28064# European Space Agency, Paris (France).

REVIEW OF THEORETICAL AND EXPERIMENTAL RESULTS ON THREE-DIMENSIONAL TURBULENT WAKES AND BOUNDARY LAYERS

J. Cousteix, B. Aupoix, and G. Pailhas Apr. 1981 90 p refs Transl. into ENGLISH from "Synthese de resultats theoriques et experimentaux sur les couches limites et sillages turbulents tridimensionnels" ONERA report ONERA-NT-1980-4, Paris, 1980 Original report in FRENCH previously announced as N81-12476
(ESA-TT-678; ONERA-NT-1980-4) Avail: NTIS HC A05/MF A01

Various turbulence models are analyzed for boundary layer predictions. Models in which a nonalignment is introduced a priori between the turbulent shear stress and the partial derivative of the velocity relative to the Y coordinate and those in which a heuristic equation is proposed for calculating the direction of the shear force are included. The influence of the direction of the shear stress is studied. Various solutions taking into account the nonalignment between the shear stress and the velocity derivative in the direction normal to the wall are discussed. The effect of allowing for this nonalignment in an integral method is described. The results are compared with those of a wind tunnel experiment with a wake which is initially strongly asymmetric and three dimensional. Detailed measurements were made of the mean velocities and of the six components of the Reynolds stress tensor. Author (ESA)

N81-28065# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

AERODYNAMIC CHARACTERISTICS OF A CURVED PLATE AIRFOIL SECTION AT REYNOLDS NUMBERS 60,000 AND 100,000 AND ANGLES OF ATTACK FROM MINUS 10 TO +90 DEGREES

A. Bruining May 1979 43 p refs
(VTH-LR-281) Avail: NTIS HC A03/MF A01

The results of lift and drag measurements on a two dimensional airfoil consisting of a circular arc, steel plate with 10% camber are presented. The measurements involved the

determination of the influence of a turbulence inducing spar (diameter 6.67% chord) mounted at different positions around the blade (at the leading edge and at 25% and 50% chord on the upper and lower surfaces). The measurements were performed in a low speed wind tunnel. The results show that a spar position on the low pressure side of the blade leads to a lift-drag ratio of not better than 5. The other spar positions produce lift-drag ratios on the order of 20. Author (ESA)

N81-28066# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

SOME LOW SPEED WIND TUNNEL EXPERIMENTS ON A SHARP-EDGED DELTA WING OF ASPECT RATIO 1, WITH AND WITHOUT YAW

N. G. Verhaagen Aug. 1979 83 p refs
(VTH-LR-283) Avail: NTIS HC A05/MF A01

An uncambered, sharp-edged delta wing of aspect ratio 1 was tested in a 1.8 m by 1.25 m (octagonal) low speed wind tunnel. Balance measurements were carried out, determining the forces and moments at several angles of attack and yaw. The results are correlated with surface oil-flow patterns and with the behavior of leading edge vortices above the wing. Comparisons are made with the results of other investigations known from the literature. In addition, theoretical methods that predict sideslip derivatives are discussed. The results are compared with those of the experiments. The experimental results agree with those of other measurements. At small angles (alpha < 4 deg) the sideslip derivatives given by linear theories show only small differences to those determined experimentally. Cross-sectional shape and thickness ratio are thought to have an important influence on the location of the vortices and consequently on the forces and moments. Author (ESA)

N81-28067# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

SEPARATED VORTEX FLOW OVER SLENDER WINGS BETWEEN SIDE WALLS. THEORETICAL AND EXPERIMENTAL INVESTIGATION

A. Karou Aug. 1980 55 p refs
(VTH-LR-300) Avail: NTIS HC A04/MF A01

The interaction between the leading edge vortices of slender wings and wind tunnel side walls was investigated theoretically and experimentally. The theoretical model, in which the walls are represented by the image method, predicts an increase in vortex strength and in its upwards and inboard movement due to the presence of the walls. The vortex position over slender rectangular wings and over delta wings was measured in a wind tunnel for several wall positions. The measurements for the thin rectangular wing agree well with the predictions; however, the measurements for the thicker delta wing are not comparable with the calculation. A series of 6-component balance measurements with the delta wing prove that the blockage effect and lift effect wall corrections that are used for attached flow can be successfully applied for flows with strong separated vortices. Author (ESA)

N81-28068# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

THE APPLICATION OF SLENDER WING THEORY TO DELTA WINGS WITH SWEPT TRAILING EDGES

H. J. Bos Aug. 1980 127 p refs
(VTH-LR-304) Avail: NTIS HC A07/MF A01

A method for calculating the pressure distribution on a left right symmetric wing planform with a boattail trailing edge is given, using slender and not so slender wing theory. The influence of the trailing vortices on part of the planform is taken into account as is the Kutta-Joukowsky condition in the form of continuity of pressure. The method described is applied on a wing with a homogeneous downwash distribution of polynomial form. With respect to the pressure distribution, equivalence is shown to exist between the coefficients which specify the form of the leading and trailing edges and those specifying the camber. For every camber distribution, the implication is that there exists a trailing and/or a leading edge which minimizes the drag for given span, length and lift. Minimum drag is achieved if a zero'th order elliptical chordwise lift distribution is applied, provided the behavior of the sum of the zero'th and first order spanwise lift distribution is also elliptical. A finite load at the apex of the wing yields infinite wave drag, although following a delta function-like loading at the apex would also minimize the sonic boom. Author (ESA)

N81-28069# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.

TROUBLE SHOOTING IN AERONAUTICS AND THE USEFULNESS OF MICROSCOPES

J. Schijve Sep. 1980 18 p refs Presented at 7th European Congr. on Electron Microscopy. Session on Impact of Electron Microscopy on Soc., the Hague, 25-29 Aug. 1980
(VTH-LR-305) Avail: NTIS HC A02/MF A01

The usefulness of the scanning electron microscope and transmission electron microscope for materials fatigue investigations in aeronautics is illustrated by case histories of practical applications. Civil air safety as a motive for these studies is cited. The detailed examination of fracture surfaces on aircraft structures is described. Fatigue crack growth analysis, microscopical observation and fractography as part of accident investigations are reviewed. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

No abstracts in this category.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-28070*# Research Triangle Inst., Research Triangle Park, N. C.

FEASIBILITY OF COLLISION WARNING, PRECISION APPROACH AND LANDING USING GPS, VOLUME 1 Final Contractor Report, May 1979 - Jul. 1980

W. H. Ruedger Mar. 1981 120 p refs
(Contract NAS1-15833)
(NASA-CR-165675; RTI/1825/01-01F) Avail: NTIS HC A06/MF A01 CSCL 17G

The use of GPS, with an appropriately configured data link, to enhance general aviation avionic functions encountered in the terminal area and on approach was investigated with emphasis on approach and landing guidance and collision warning. The feasibility of using differential GPS to obtain the precision navigation solutions required for landing was studied. Results show that the concept is sound. An experimental program was developed to demonstrate this concept. The collision avoidance/warning concept was examined through the development of a functional system specification. A.R.H.

N81-28071*# Magnavox Government and Industrial Electronics Co., Falls Church, Va. Advanced Systems Analysis Office.

DEFINITION STUDY OF LAND/SEA CIVIL USER NAVIGATIONAL LOCATION MONITORING SYSTEMS FOR NAVSTAR GPS: USER REQUIREMENTS AND SYSTEMS CONCEPTS

D. M. DeVito 7 May 1981 103 p refs
(Contract NAS5-23425)
(NASA-CR-166698; ASAO-PR20093-1) Avail: NTIS

HC A06/MF A01 CSCL 17G

A low-cost GPS civil-user mobile terminal whose purchase cost is substantially an order of magnitude less than estimates for the military counterpart is considered with focus on ground station requirements for position monitoring of civil users requiring this capability and the civil user navigation and location-monitoring requirements. Existing survey literature was examined to ascertain the potential users of a low-cost NAVSTAR receiver and to estimate their number, function, and accuracy requirements. System concepts are defined for low cost user equipments for in-situ navigation and the retransmission of low data rate positioning data via a geostationary satellite to a central computing facility. A.R.H.

N81-28072*# Baker Development Corp., Sherwood Forest, Md.
SATELLITE-AIDED COASTAL ZONE MONITORING AND VESSEL TRAFFIC SYSTEM Final Report
James L. Baker Jun. 1981 92 p refs
(Contract NAS5-25105)
(NASA-CR-166699) Avail: NTIS HC A05/MF A01 CSCL 17G

The development and demonstration of a coastal zone monitoring and vessel traffic system is described. This technique uses a LORAN-C navigational system and relays signals via the ATS-3 satellite to a computer driven color video display for real time control. Multi-use applications of the system to search and rescue operations, coastal zone management and marine safety are described. It is emphasized that among the advantages of the system are: its unlimited range; compatibility with existing navigation systems; and relatively inexpensive cost. E.A.K.

N81-28073*# Magnavox Co., Torrance, Calif.
CIVIL APPLICATION OF DIFFERENTIAL GPS USING A SINGLE CHANNEL SEQUENTIAL RECEIVER Final Report
May 1981 93 p refs
(NASA Order A-80182-B)
(NASA-CR-166168; R-6316) Avail: NTIS HC A05/MF A01 CSCL 17G

The Global Positioning System (GPS) and its potential for area navigation, landing, and takeoff under minimum ceilings and advanced air traffic control operation is discussed. The following topics are reported: status of the GPS system; GPS signal availability for the civil community; alternative differential GPS concepts; predicted performance enhancement achievable with differential GPS and the operational improvements which will result; and a development program to test and evaluate differential GPS concepts, performance and operational procedures applicable to helicopters. Potential benefits which will be derived from helicopter use of GPS in the differential mode are identified. E.A.K.

N81-28074*# Intermetrics, Inc., Huntington Beach, Calif.
THE APPLICATION OF NAVSTAR DIFFERENTIAL GPS TO CIVIL HELICOPTER OPERATIONS Final Report
Jacques Beser and Bradford W. Parkinson Jun. 1981 99 p refs
(NASA Order A-81060-B)
(NASA-CR-166169; IR-CA-01) Avail: NTIS HC A05/MF A01 CSCL 17G

Principles concerning the operation of the NAVSTAR Global Positioning Systems (GPS) are discussed. Selective availability issues concerning NAVSTAR GPS and differential GPS concepts are analyzed. Civil support and market potential for differential GPS are outlined. It is concluded that differential GPS provides a variation on the baseline GPS system, and gives an assured, uninterrupted level of accuracy for the civilian community. E.A.K.

N81-28075# Federal Aviation Administration, Atlantic City, N.J.
LORAN-C IN MOUNTAINOUS AREAS. PHASE 1: VERMONT TESTS Interim Report, Sep. 1979 - Mar. 1980
Lorraine Rzonca Apr. 1981 22 p refs
(AD-A100552; FAA-CT-81-22; FAA-RD-81-24) Avail: N HC A02/MF A01 CSCL 17/7

Flight tests were conducted in the State of Vermont to determine the suitability of long range navigation (LORAN)-C for airborne area navigation (RNAV) operations in mountainous areas. A production receiver, the Teledyne TDL-711, and a ground-based multi-distance measuring equipment (DME) reference system were used to obtain accuracy statistics during en route flights and nonprecision approaches to four airports. The Federal Aviation Administration (FAA) accuracy criteria (Advisory Circular AC 90-45A) were met for both nonprecision approaches and en route flights when the primary triad (Seneca, Caribou, Nantucket) was used and when no automatic triad switches occurred during the flight. The mean value of the LORAN-C grid bias for the primary triad was generally 0.1 nautical miles (nmi) or less at each of the four airports; however, the bias for the alternate triad (Seneca, Nantucket, Carolina Beach) was significant (1.9 nmi north and 0.5 nmi east at Burlington Airport. Author (GRA)

N81-28076# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
AN ANALYSIS OF THE REQUIREMENTS FOR, AND THE BENEFITS AND COSTS OF THE NATIONAL MICROWAVE LANDING SYSTEM (MLS)
William C. Reddick, Seymour M. Horowitz, Eugene S. Rehrig, and Gilbert P. Christiana Jun. 1980 75 p refs
(AD-A100136; FAA-EM-80-7) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report consists of three volumes, i.e.: (1) this Executive Summary, (2) Volume I comprising the detailed study analysis, and (3) Volume II which contains reprints of important studies supporting the analysis included in the report. The analysis assesses the comparative desirability of implementing the MLS equipment option in place of the currently installed ILS as the long term National standard for precision guidance service. An evaluation period of 20 years, to the year 2000, was used for this assessment. An implementation strategy was devised to achieve the estimated National requirement for 1250 ground installations by the year 2000 and providing precision guidance service, alternatively, with the ILS or MLS equipment option. The study's method was to examine the technical and performance specifications for the MLS and to estimate the dollar amounts of benefits resulting from the portion of these specifications which could be quantified. The dollar amounts of comparative costs to the community of aviation users and to the FAA from the alternative use of MLS instead of ILS were, likewise, estimated. The study results show that implementation of MLS can provide sizeable benefits in excess of costs, in varying degrees, to the different aviation user groups (i.e., air carriers, commuter airlines, general aviation and the military). Author (GRA)

N81-28077# Federal Aviation Administration, Washington, D.C.
THE FAA PLANS AND PROGRAMS FOR THE FUTURE AIRPORT AND AIR TRAFFIC CONTROL SYSTEM
13 Nov. 1980 184 p refs Presented at the Office of Technol. Assessment Seminar
(AD-A100370) Avail: NTIS HC A09/MF A01 CSCL 17/7

Contents' FAA's Role in Providing a Safe and Efficient System; FAA Forecasts of Aviation Activity, 1981-1992 - Airport and Airway System Capacity and Delay Overview' Today's ATC System-Problems and Need for Change; An Overview of the FAA Engineering and Development Program; Scenario for the Future System - The Roadmap of the System of the Future - The Impact of Alternative Approaches in Air Traffic Control System Evolution; Airport Capacity Increases - Opportunities, Limitations, and Choices; Near Term System Improvements; Long Term ATC System Improvements; and Nontechnological Alternatives for Balancing Airport/Airspace Supply and Demand. GRA

N81-28078# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SENSITIVITY STUDY OF STRAPDOWN INERTIAL SENSORS IN HIGH PERFORMANCE APPLICATIONS M.S. Thesis
John E. Ryan Dec. 1980 225 p refs
(AD-A100825; AFIT/GE/EE/80D-38) Avail: NTIS HC A10/MF A01 CSCL 17/7

This study uses a computer simulation of a strapdown laser gyro inertial reference system to analyze the errors generated as a result of highly dynamic flight profiles. A stochastic error model using state-of-the-art inertial sensors is developed in detail and implemented in software. SOFE, a generalized simulation program, was used to implement both a Monte Carlo simulation and a covariance analysis. The Monte Carlo method was selected to perform the error analysis. Two highly dynamic flight trajectories

were developed using the flight profile generator, PROFGEN. The PROFGEN program itself was modified to include an aircraft roll time constant and a roll-only maneuver. The errors generated in the inertial reference system as a result of these flight trajectories were investigated. Both an error budget and an analysis of the maneuvers inducing these errors were accomplished. Gyro error sources induced the most system error and coupled the dynamics of the flight trajectory into the variations of the error. Misalignment was found to be the major cause of both the accelerometer and gyro induced error. Successive maneuvers were found that reinforced system errors and other maneuvers were found that cancelled these errors. Also, some cases were found where the amount of system error varied with a change in heading.
Author (GRA)

N81-28079# European Space Agency, Paris (France).
APPLIED TECHNIQUES FOR THE CONTROL OF APPROACH TRAFFIC
Albrecht Seyfried, Manfred Schubert, and Uwe Voelckers Jan. 1981 28 p refs Transl. into ENGLISH from "Angewendete Techniken zur Steuerung des Anflugverkehrs" DFVLR-Mitt-79-20, DFVLR, Brunswick, Oct. 1979 Original report in GERMAN previously announced as N81-14992
(ESA-TT-668; DFVLR-Mitt-79-20) Avail: NTIS HC A03/MF A01

Flow control measures applied in a selected local traffic area were investigated by the analysis of real traffic recordings as well as from controller interviews. The internal procedures consist of variable control of the individual aircraft within the approach control terminal maneuvering area (TMA), i.e., the local approach phase. Flight profiles of shorter or longer duration are prescribed in order either to accelerate or retard respectively, the approach flight of aircraft within this region. The external control procedures of the approach controllers takes into account entry rates at the sector control. The retardation of traffic outside the approach control TMA is largely achieved through holding procedures. The acceleration of individual flights is possible through the direction of traffic onto shorter routes. The degree to which the various flow control techniques should be considered in a future computer assisted air traffic conrol system is discussed. Author (ESA)

N81-28080# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabteilung Programhvorbereitung.
A METHOD FOR EVALUATING RADIO NAVIGATION SYSTEMS FOR THE TERMINAL MANEUVERING AREA
Jens Fromm and Joachim Majus Feb. 1981 27 p refs
(DFVLR-Mitt-81-02) Avail: NTIS HC A03/MF A01

The methodology of standard cost/benefit analysis fails in the case of the evaluation of radio navigation system technologies for the terminal maneuvering area. The proposed problem-matched method defines those system configurations as 'feasable' evaluation alternatives that fulfill predefined quantitative requirements with respect to position fix capability. Among the feasable alternatives of each candidate technology there is one 'minimal cost solution'. These minimal cost figures form the basis of the assessment of the candidate technologies. The method is demonstrated by way of a fictitious example. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-28081 Oklahoma State Univ., Stillwater.
HANDLING QUALITIES OF LARGE FLEXIBLE AIRCRAFT Ph.D. Thesis
Supat Poopaka 1980 71 p
Avail: Univ. Microfilms Order No. 8113329

The effects on handling qualities of elastic models interaction with the rigid body dynamics of a large flexible aircraft are studied by a mathematical computer simulation. An analytical method to predict the pilot ratings when there is a severe modes interaction is developed. The handling qualities are determined for a longitudinal tracking task using a large flexible aircraft with parametric variations in the undamped natural frequencies of the two lowest frequency, symmetric elastic modes made to induce varying amounts of mode interaction. The modified model of the human pilot response developed proved successful in discriminating when the pilot can or cannot separate rigid from elastic response in the tracking task. The modified pilot model is much better in predicting the elastic modes interaction effect on the handling qualities than the standard optimal control model of the human pilot. Dissert. Abstr.

N81-28082 Purdue Univ., Lafayette, Ind.
A LEAST SQUARES METHOD FOR CONSTRAINED MINIMIZATION WITH APPLICATION IN STRUCTURAL DESIGN
Laurence Bellagamba 1980 165 p
Avail: Univ. Microfilms Order No. 8113648

A technique for constrained parameter optimization is presented and applied to some test problems. The procedure employs an exterior penalty function to transform the constrained objective function into an unconstrained index of performance which is minimized by Gauss' method. Gauss' method recasts the minimization problem to one of solving simultaneous linear equations with the variation of the parameters as the unknowns. For the special case of a quadratic objective function and linear constraints, the penalized critical value is obtained in one step. The restriction that the objective function be of least squares form results from using Gauss' method. The restriction on each constraint is that first derivatives with respect to all parameters be obtainable. A modified version of the technique is applied to the minimum-mass design of truss type structures. The standard problems are altered to introduce local buckling constraints and new designs are obtained. Finally, to demonstrate the methods capabilities, static thermal loads are introduced and an equality constraint is imposed on the fundamental natural frequency of each structure. Dissert Abstr

N81-28083*# National Aeronautics and Space Administration, Washington, D. C.
AIRCRAFT ENERGY EFFICIENCY. OVERVIEW
[1981] 7 p
(NASA-Facts-96/9-80; NASA-TM-80454) Avail: NTIS HC A02/MF A01 CSCL 01C

Six advanced technology development projects that could cut fuel consumption of future civil air transports by as much as 50 percent are highlighted. These include improved engine components; better engine design; thin short blades for turboprop aircraft; using composite primary structures for weight reduction; the use of supercritical wings, higher aspect ratio, and winglets for improved aerodynamics; active controls; and laminar flow control. The time span of each of the six efforts and NASA's expected expenditures are also discussed. A.R.H.

N81-28084*# Vought Corp., Dallas, Tex.
A MATHEMATICAL MODEL FOR VERTICAL ATTITUDE TAKEOFF AND LANDING (VATOL) AIRCRAFT SIMULATION. VOLUME 1: MODEL DESCRIPTION APPLICATION Final Report
Robert L. Fortenbaugh Dec. 1980 228 p refs 3 Vol.
(Contract NAS2-10294)
(NASA-CR-166129-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 01C

A mathematical model of a high performance airplane capable of vertical attitude takeoff and landing (VATOL) was developed. An off line digital simulation program incorporating this model was developed to provide trim conditions and dynamic check runs for the piloted simulation studies and support dynamic analyses of proposed VATOL configuration and flight control concepts. Development details for the various simulation component models and the application of the off line simulation program, Vertical Attitude Take-Off and Landing Simulation (VATLAS), to develop a baseline control system for the Vought SF-121 VATOL airplane concept are described. E.A.K

N81-28085*# Vought Corp., Dallas, Tex.
A MATHEMATICAL MODEL FOR VERTICAL ATTITUDE

TAKEOFF AND LANDING (VATOL) AIRCRAFT SIMULATION. VOLUME 2: MODEL EQUATIONS AND BASE AIRCRAFT DATA
Robert L. Fortenbaugh Dec. 1980 90 p refs 3 Vol.
(Contract NAS2-10294)
(NASA-CR-166129-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01C

Equations incorporated in a VATOL six degree of freedom off-line digital simulation program and data for the Vought SF-121 VATOL aircraft concept which served as the baseline for the development of this program are presented. The equations and data are intended to facilitate the development of a piloted VATOL simulation. The equation presentation format is to state the equations which define a particular model segment. Listings of constants required to quantify the model segment, input variables required to exercise the model segment, and output variables required by other model segments are included. In several instances a series of input or output variables are followed by a section number in parentheses which identifies the model segment of origination or termination of those variables. E.A.K.

N81-28086*# Vought Corp., Dallas, Tex.
A MATHEMATICAL MODEL FOR VERTICAL ATTITUDE TAKEOFF AND LANDING (VATOL) AIRCRAFT SIMULATION. VOLUME 3: USER'S MANUAL FOR VATOL SIMULATION PROGRAM
Robert L. Fortenbaugh Dec. 1980 425 p refs 3 Vol.
(Contract NAS2-10294)
(NASA-CR-166129-Vol-3) Avail: NTIS HC A18/MF A01 CSCL 01C

Instructions for using Vertical Attitude Takeoff and Landing Aircraft Simulation (VATLAS), the digital simulation program for application to vertical attitude takeoff and landing (VATOL) aircraft developed for installation on the NASA Ames CDC 7600 computer system are described. The framework for VATLAS is the Off-Line Simulation (OLSIM) routine. The OLSIM routine provides a flexible framework and standardized modules which facilitate the development of off-line aircraft simulations. OLSIM runs under the control of VTOLTH, the main program, which calls the proper modules for executing user specified options. These options include trim, stability derivative calculation, time history generation, and various input-output options. E.A.K.

N81-28087# Sikorsky Aircraft, Stratford, Conn.
ADVANCING BLADE CONCEPT (ABC) TECHNOLOGY DEMONSTRATOR Final Report, Jan. 1972 - Jun. 1980
A. J. Ruddell, W. Groth, and R. McCutcheon Apr. 1981 303 p refs
(Contracts DAAJ02-72-C-0020; DAAJ02-75-C-0009; DA Proj. 1F2-63211-D-157)
(AD-A100181; SER-69065; USAAVRADCOM-TR-81-D-5) Avail: NTIS HC A14/MF A01 CSCL 01/3

The XH-59A Advancing Blade Concept (ABC) demonstrator aircraft has completed five years of ground and flight tests in both the helicopter and auxiliary propulsion configurations. This testing was supported by wind tunnel tests, analytical developments, and flight simulation studies. Testing as a pure helicopter was accomplished in two phases. To verify control system adequacy, a low speed test program was flown (0 to 80 knots) from July to September 1975. The balance of the flight envelope was explored in progressive steps from November 1975 to March 1977. A power-limited maximum level flight speed of 156 KTAS was reached in this phase, 186 KTAS was achieved in a shallow dive and an extensive maneuver envelope was developed. Between April 1978 and May 1980 the aircraft was flown with two J-60 engines installed to provide auxiliary propulsion. A maximum airspeed of 238 KTAS in level flight was reached and a sizable maneuver envelope was developed through 220 KTAS. A total of 106 flight hours were accumulated in the pure helicopter and auxiliary propulsion modes. Test results to data have verified the capability of the Advancing Blade Concept to meet its predicted technical goals. No major surprises or unanticipated problems have been encountered. GRA

N81-28088# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aerospace Medical Div.
THE RESULTS OF AFAMRL REMOTELY PILOTED VEHICLE (RPV) SIMULATION STUDIES 7 AND 8
Nilss M. Aume and Robert G. Mills May 1981 40 p refs
Prepared in cooperation with Dayton Univ., Ohio
(Contract F33615-77-C-0520; AF Proj. 2313)
(AD-A100551; AFAMRL-TR-80-98) Avail: NTIS HC A03/MF A01 CSCL 01/3

In RPV Study VII, the main interest was in the composition of three teams of five operators each: do independent teams whose individual members belong to one team perform differently from teams whose members are chosen from a limited pool of operators such that each operator performs on two teams? In RPV Study VIII, another aspect of team compostition was investigated: how is the performance of an individual operator reflected in the performance of a team and across teams of varying sizes? In both studies, the operators were highly experienced in the control of the simulated RPV system. Both studies employed scenarios requiring that support RPVs provide coverage for a set of weapon delivery/strike RPVs. The RPV system was assumed to operate in an environment where a radio frequency has to be shared by multiple users, so that a time slot for command and telemetry transmissions becomes available for RPV system use only on a periodic basis. The results of RPV Study VII indicated that average performance remained unchanged from independently constituted teams to pooled constituted teams. However, the variability in terms of standard deviations of dependent measures was reduced. The results of RPV Study VIII indicated that operator-centered tasks are largely unaffected by team size on the same tasks. Workload, in terms of the number of RPVs to be controlled, had an effect on performance by itself but had no differential effect over team sizes or operators. GRA

N81-28089# Michigan State Univ., East Lansing. Div. of Engineering Research.
PACER LIME: AN ENVIRONMENTAL CORROSION SEVERITY CLASSIFICATION SYSTEM, PART 1 Final Report, 15 Sep. 1978 - 31 Dec. 1979
Robert Summitt Wright-Patterson AFB, Ohio AFWAL Aug. 1980 129 p refs
(Contract F33615-78-C-5224; AF Proj. 3930)
(AD-A100496; AFWAL-TR-80-4102-Pt-1; TR-80-4102-Pt-1)
Avail: NTIS HC A07/MF A01 CSCL 01/3

A system has been developed for rating the corrosivity of aircraft operational environments. This system takes account of weather, atmospheric pollutant, and geographical factors to compute a severity index for three aspects of corrosion maintenance: aircraft washing, repainting, and repair needs. Computed ratings are in good agreement with aircraft corrosion experience and atmospheric testing programs at several locations. Author (GRA)

N81-28090# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
OPTIMIZATION OF STRATEGIC AIRLIFT IN FLIGHT REFUELING M.S. Thesis
Vernon P. Bordelon, Jr. and John C. Macotte, Jr. Mar. 1981 214 p refs
(AD-A101137; AFIT/GST/OS/81M-3) Avail: NTIS HC A10/MF A01 CSCL 01/2

During the 1980s increases in the potential use of Strategic Airlift to transport equipment and personnel is anticipated. The capabilities of Strategic Airlift aircraft are extended through the inclusion of efficient in-flight refueling. The primary objective of this research was to develop a method which determines the combination of in-flight refueling rendezvous point, takeoff fuel loads and tanker base which results in the minimum total fuel consumption for an airlifter and tanker aircraft. The experimental design included the creation of two models. An analytic flight planning model determined the optimal rendezvous point and the takeoff fuel loads for the aircraft in a specific mission scenario. A SLAM simulation model verified the operational feasibility of the results of the analytic model by simulating the flights of aircraft. GRA

N81-28091# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
QUANTIFYING REACTIVE MANEUVERS M.S. Thesis
John J. Alt Mar. 1981 220 p refs
(AD-A101136; AFIT/GST/OS/81M-1) Avail: NTIS

HC A10/MF A01 CSCL 01/3

There is currently no value of survivability attributed to an aircraft's reactive maneuver capability. In this experiment, exposure to enemy ground threats for various levels of information feedback to the aircrew were compared. This was done in an attempt to isolate the maneuverability factor. The Threat Model Penetration Simulation Analysis (TMPSA) model produced by the University of Dayton Research Institute was the penetration model used. The conclusion of this experiment was that only order of magnitude differences in capabilities can be captured with this model. It is recommended that two simple changes be made to TMPSA. These changes would allow more precise values for reactive maneuvers to be derived. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-28092# Aeronautical Research Labs., Wright-Patterson AFB, Ohio. Directorate of Avionics Engineering.

AFSC STANDARDIZATION CONFERENCE, 1553, 1589, 1750, 1760, ADA. VOLUME 1: PROCEEDINGS

Erwin C. Gangl Nov. 1980 560 p refs Conf. held in Dayton, Ohio, 18-20 Nov. 1980

(AD-A100575; ASD-TR-80-5050-Vol-1) Avail: NTIS HC A24/MF A01 CSCL 01/3

This is a collection of unclassified papers to be distributed to the attendees of the AFSC Avionics Standardization Conference at the Convention Center, Dayton, Ohio. The purpose of the conference is to state AF policy on standardization, educate government and industry management, and present and demonstrate hardware and software tools. GRA

N81-28093# Aeronautical Research Labs., Wright-Patterson AFB, Ohio. Directorate of Avionics Engineering.

AFSC STANDARDIZATION CONFERENCE, 1553, 1589, 1750, 1760, ADA. VOLUME 2: PROCEEDINGS STANDARDS

Erwin C. Gangl, ed. and Stephen E. Smith, ed. Nov. 1980 476 p refs Conf. held in Dayton, Ohio, 18-20 Nov. 180

(AD-A100577; ASD-TR-80-5050-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 01/4

This is a collection of unclassified papers to be distributed to the attendees of the AFSC Avionics Standardization Conference at the Convention Center, Dayton, Ohio. The purpose of the conference is to state AF policy on standardization, educate government and industry management, and present and demonstrate hardware and software tools. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-28094*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

COATING FOR PREVENTION OF TITANIUM COMBUSTION Final Report, 9 Feb. 1979 - 9 Jun. 1980

V. G. Anderson, M. Funkhouser, and P. McDaniel Sep. 1980 76 p refs

(Contract NAS3-21815)

(NASA-CR-165360; FR-13370) Avail: NTIS HC A05/MF A01 CSCL 21E

A limited number of coating options for titanium gas turbine engine components were explored with the objective of minimizing potential combustion initiation and propagation without adversely affecting component mechanical properties. Objectives were met by two of the coatings, ion-plated platinum plus electroplated copper plus electroplated nickel and ion vapor deposited aluminum. Author

N81-28095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE E3 COMBUSTORS: STATUS AND CHALLENGES

Daniel E. Sokolowski and John E. Rohde 1981 24 p refs Presented at 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE and ASME

(NASA-TM-82684; E-904) Avail: NTIS HC A02/MF A01 CSCL 21E

The design, fabrication, and initial testing of energy efficient engine combustors, developed for the next generation of turbofan engines for commercial aircraft, are described. The combustor designs utilize an annular configuration with two zone combustion for low emissions, advanced liners for improved durability, and short, curved-wall, dump prediffusers for compactness. Advanced cooling techniques and segmented construction characterize the advanced liners. Linear segments are made from castable, turbine-type materials. M.G.

N81-28096*# General Dynamics Corp., Fort Worth, Tex.

STUDY OF AN ENGINE FLOW DIVERTER SYSTEM FOR A LARGE SCALE EJECTOR POWERED AIRCRAFT MODEL Final Report

R. J. Springer, B. Langley, T. Plant, L. Hunter, and O. Brock Jul. 1981 138 p refs

(Contract NAS2-10680)

(NASA-CR-166163) Avail: NTIS HC A07/MF A01 CSCL 21E

Requirements were established for a conceptual design study to analyze and design an engine flow diverter system and to include accommodations for an ejector system in an existing 3/4 scale fighter model equipped with YJ-79 engines. Model constraints were identified and cost-effective limited modification was proposed to accept the ejectors, ducting and flow diverter valves. Complete system performance was calculated and a versatile computer program capable of analyzing any ejector system was developed. A.R.H.

N81-28097*# Pennsylvania State Univ., University Park. Turbomachinery Lab.

END WALL FLOWS IN ROTORS AND STATORS OF A SINGLE STAGE COMPRESSOR Semiannual Progress Report

T. R. Govindam, B. Lakshminarayana, A. Pandya, and M. Pouagare Aug. 1981 50 p refs

(Grant NsG-3212)

(NASA-CR-164635; PSU/TURBO-R81-7) Avail: NTIS HC A03/MF A01 CSCL 21E

A solution of the flow in the rotor end wall region, including the effects of tip clearance flow, is presented. A method for leakage flow measurement at the tip of a compressor rotor blade is discussed. Measurements are given for a rotor hub wall boundary layer. T.M.

N81-28098# General Electric Co., Lynn, Mass. Aircraft Engine Group.

T700 TURBINE NOZZLE MANUFACTURING TECHNOLOGY PROGRAM. COMPUTER ASSISTED EDM. COOLING FLOW MEASUREMENT BY IR. AUTOMATED OPTICAL AREA MEASUREMENT Final Report, Aug. 1978 - Mar. 1980

G. R. Dearth, T. Bantel, D. Mack, and V. Bolduc Jan. 1981 98 p

(Contract DAAG46-78-C-0001)

(AD-A100294; R79AEG566) Avail: NTIS HC A05/MF A01 CSCL 21/5

This program consisted of three separate tasks relative to the improvement of T700 turbine nozzle manufacturing process. (1) Computer Assisted EDM - This report documents a series of four experiments performed at the Manufacturing Technology Laboratory in Evendale to assess the potential benefits of a computer assisted (programmable) varying EDM power supply to reduce the time required for this machining operation. The experiments revealed a parameter profile which is optimum for this machining operation and will reduce the time required for

machining trailing edge cooling holes. (2) Cooling Flow Measurement by Infrared Inspection - This report describes the procedures developed, equipment assembled, and results obtained in a study performed by General Electric Aircraft Engine Business Group (GE-AEBG) for the United States Army to apply infrared inspection to T700 nozzle segments for the purpose of detecting blocked airfoil surface cooling holes and for the purpose of estimating cooling flow rate. (3) Automated Optical Area Measurement This report presents the results of a joint effort by General Electric Aircraft Engine Business Group and Bausch Lomb Analytical Systems Division, for the U.S. Army, to determine the feasibility of using a computerized image analysis technique to measure the exit areas of T700 stage 1 turbine nozzles. GRA

N81-28099# AeroChem Research Labs., Inc., Princeton, N. J.
CORRELATION OF SOOT FORMATION IN TURBOJET ENGINES AND IN LABORATORY FLAMES Final Report, Aug. - Sep. 1980
Robert K. Gould, Douglas B. Olson, and Hartwell F. Calcote Feb. 1981 69 p refs
(Contract F49620-77-C-0029; AF Proj. 1900)
(AD-A100525; AEROCHEM-TP-407; AFESC/ESL-TR-81-09)
Avail: NTIS HC A04/MF A01 CSCL 21/4

Data obtained from aviation gas turbine combustor tests have been examined to determine the effects of fuel properties on soot-related measurements such as engine smoke number, combustor flame radiation, and/or combustor linear temperature. Some tests of smaller laboratory combustors used to simulate these large combustors were also examined. From the existing data it is clear that soot production is a strong function of the fuel chemical composition. Variations in the physical properties of the fuel do not correlate well with soot-related effects. In studies in which a broad range of fuel properties was examined, correlation of soot-related effects with basic fuel compositional parameters including (1) the hydrogen content of the fuel; (2) the aromatic content of the fuel; and (3) the amount of multiple-ring aromatics in the fuel show that typically only the first of these correlates well. However, it has also been shown that fuel compositions can be chosen for which this correlating parameter fails. GRA

N81-28100# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
AERODYNAMIC AND AEROELASTIC RESEARCH ON TIPVANE TURBINES
G. J. W. vanBussel, P. C. Hensing, and G. A. M. vanKuik Aug. 1980 22 p refs
(VTH-LR-302) Avail: NTIS HC A02/MF A01

The present status of the tipvane project is surveyed. Tipvanes are small auxiliary wings mounted at the tips of turbine blades in such a way that a diffuser effect is generated, resulting in a mass flow augmentation past the turbine disk. A gross power coefficient of 1.5, measured in a wind tunnel with turbine blades simulated by gauzes, is reported. Two research efforts are treated in greater detail: (1) analytical aerodynamics accompanied by experimental verification; and (2) aeroelastic work, theoretical as well as experimental. The first is characterized by the particular flow phenomena induced by the tipvanes, such as interfering tip vortices. The second reveals the very low torsional frequency of the blade-tipvane configuration. The field test installation, to be erected, is described. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-28101 Kansas Univ., Lawrence.
NEW DESIGN METHOD FOR AUTOMATIC FLIGHT CONTROL SYSTEMS Ph.D. Thesis
Toshihiro Konishi 1980 461 p
Avail: Univ. Microfilms Order No. 8111788

The relationship between the cost function and the optimal control law was investigated. It was shown that Butterworth pole configurations give good responses and that such configurations can be used as new design criteria. By using this design criterion, design methods for SAS and automatic flight control systems were developed and it was shown that these methods were very simple and straightforward. The design criteria which were derived from theoretical derivation showed good agreement with the empirical criteria such as the short period handling qualities criteria in MIL-F-8785B. In the case of incomplete measurements, the design method was developed via a transformation matrix. Dissert. Abstr.

N81-28102*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
PILOT-OPTIMAL MULTIVARIABLE CONTROL SYNTHESIS BY OUTPUT FEEDBACK
David K. Schmidt and Mario Innocenti Jul. 1981 24 p refs (Grant NAG4-1)
(NASA-CR-163112) Avail: NTIS HC A02/MF A01 CSCL 01C

A control system design approach for optimal stability augmentation, systems, using limited state feedback theory with the specific inclusion of the human pilot in the loop is presented. The methodology is especially suitable for application to flight vehicles exhibiting nonconventional dynamic characteristics and for which quantitative handling qualities specifications are not available. The design is based on a correlation between pilot ratings and objective function of the optimal control model of the human pilot. Simultaneous optimization for augmentation and pilot gains are required. E.A.K.

N81-28103# Kuhn (Richard E.), Newport News, Va.
AN ENGINEERING METHOD FOR ESTIMATING THE LATERAL/DIRECTIONAL CHARACTERISTICS OF V/STOL CONFIGURATIONS IN TRANSITION Final Technical Report
Richard E. Kuhn Feb. 1981 61 p refs
(Contract N62269-80-C-0366)
(AD-A100386; NADC-81031-60) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method for estimating the power induced increments of side-force and yawing and rolling moments in the transition speed range is presented and compared with available data. The study shows that in addition to the expected inlet effects and the lateral shift in the induced downloads on the body and wing there is a large favorable sidewash induced at the vertical tail as well as suction pressures induced on the leeward side of the body that add significantly to the side-force and rolling and yawing moments. Author (GRA)

N81-28104# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
FLUTTER ANALYSIS OF TWO-DIMENSIONAL AND TWO-DEGREE-OF-FREEDOM MBB A-3, CAST 7, AN TF-8A SUPERCRITICAL AIRFOILS IN SMALL-DISTURBANCE UNSTEADY TRANSONIC FLOW Final Report, Nov. 1979 - Oct. 1980
T. Y. Yang, Alfred G. Striz, and P. Guruswamy Mar. 1981 116 p refs
(Grant AF-AFOSR-3523-78; AF Proj. 2307)
(AD-A100334; AFWAL-TR-81-3004) Avail: NTIS HC A06/MF A01 CSCL 20/4

Flutter analyses at transonic Mach numbers are performed for three supercritical airfoils: (1) MBB A-3; (2) CAST 7; and (3) TF-8A wing section at the 65.3% semispan station. For all airfoils, two degrees of freedom, pitching and plunging, are considered. The unsteady aerodynamic data are obtained by using two separate transonic aerodynamic computational codes: (1) LTRAN2 based on the time integration method and (2) STRANS2 and UTRANS2 based on the harmonic analysis method. The steady aerodynamic results are shown in the form of upper and lower surface pressure curves. The unsteady aerodynamic coefficients are obtained for various values of low reduced frequencies by pitching the airfoils about the quarter chord axis. Unsteady results are presented as plots of unsteady coefficients versus angle of attack for the MBB A-3 airfoil and versus Mach number for the CAST 7 and TF-8A airfoils. GRA

N81-28105# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

FLIGHT CONTROL SYSTEM ANALYSIS AND DESIGN FOR A REMOTELY PILOTED VEHICLE WITH THRUST VECTORING UNIT M.S. Thesis

Brian Leigh Jones Dec. 1980 155 p refs
(AF Proj. 2403)
(AD-A100808; AFIT/GAE/AA/80D-12) Avail: NTIS HC A08/MF A01 CSCL 01/4

This study investigated the stability and control of a remotely piloted vehicle (RPV) with a thrust vectoring unit attached. All geometric and aerodynamic data was generated and used to analyze the RPV. Specific handling qualities were developed and compared with the RPV characteristics. This comparison indicated that the RPV was too oscillatory in both the phugoid and dutch roll modes. Also, the RPV displayed a dominant spiral mode. A flight control system was synthesized to eliminate these traits. Evaluation of this flight control system was conducted through the use of three different sensitivity studies and a nonlinear simulation. In addition, a model matching application was examined for this RPV. Model matching entails using design procedures to synthesize an expanded flight control system so that the RPV has dynamic characteristics similar to the F-15.
Author (GRA)

N81-28106# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

A STRUCTURAL LOAD ALLEVIATION CONTROL SYSTEM FOR A LARGE TRANSPORT AIRCRAFT

D. McLean and R. A. Prasad Jul. 1980 110 p refs
(Grant SRC-GR/A/21344)
(TT-8002) Avail: NTIS HC A06/MF A01

The results of applying linear optimal control theory in order to provide significant reductions in the bending moments at the root (and other stations) of the highly flexible wing of a large transport aircraft are presented. Digital simulation was employed. The effects of neglecting higher frequency bending modes and/or omitting unsteady aerodynamic effects are demonstrated and discussed. The efficiency of lower-order feedback control laws is also demonstrated, and the dynamic requirements for the servo-actuators associated with the active control surfaces are shown to be such that they can be achieved with present-day electrohydraulic components. Structural load alleviation is shown possible and it is demonstrated that the synthesis problem is manageable even when based on incomplete mathematical models and imperfectly synthesized feedback control.
Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-28107# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Flight Mechanics Panel.

CHARACTERISTICS OF FLIGHT SIMULATOR VISUAL SYSTEMS

May 1981 89 p refs
(AGARD-AR-164; ISBN-92-835-1386-X) Avail: NTIS HC A05/MF A01

Physical parameters that characterize the simulator visual system and determine its fidelity are identified and defined. These characteristics are discussed in terms of the three basic categories of spatial, energy and temporal properties, and for each of the parameters there is a description of its effect, a definition of its appropriate units or descriptors, a discussion of methods of measurement and of its use or importance to imagery quality.
S.F.

N81-28108# Ohio State Univ., Columbus. Lab. of Aviation Psychology.

METHODOLOGICAL APPROACHES TO IDENTIFYING RELEVANT FEATURES FOR VISUAL FLIGHT Final Report

Dean H. Owen and Richard S. Jensen Jan. 1981 179 p refs
(Contract F49620-79-C-0070; AF Proj. 2313)
(AD-A100199; AFOSR-81-0479TR) Avail: NTIS HC A09/MF A01 CSCL 05/10

A variety of optical variables relevant to rectilinear locomotion were mathematically isolated, and a paradigm was developed to determine whether optical invariants have a consistent effect on performance. Two experiments were undertaken to explore the efficacy of a paradigm designed to determine the functional utility of global optical invariants. The two tasks chosen were detection of loss in altitude and detection of loss in forward speed. The paths of simulated locomotion were constrained to rectilinear travel with no lateral movement in order to maintain a manageable level of complexity of optical flow analysis. In each case an optical variable proved to be a functional invariant by the criterion that performance was consistent even though the environment variables producing the optical invariant had radically different values. The two functional invariants were of the same type, i.e., specifying fractional or proportional change as the relevant information for displacement of the self with locomotion.
GRA

N81-28109# Ohio State Univ., Columbus. Dept. of Psychology.

ASSESSMENT OF SCENE COMPLEXITY AND CUE VALIDITY IN VISUAL FLIGHT SIMULATION Final Report, 15 Mar. 1979 - 14 Nov. 1980

Harvey G. Shulman and Paul D. Isaac 1 Mar. 1981 65 p refs
(Contract F49620-79-C-0070; AF Proj. 2313)
(AD-A100200; AFOSR-81-0480TR) Avail: NTIS HC A04/MF A01 CSCL 05/10

The human visual system is theorized to behave as a set of spatial frequency filters. The project developed the means to measure and manipulate the spatial frequency content of computer generated images representative of those to be used in future flight simulators. Experimental measurement of perceived clarity and complexity showed that spatial frequency content influences the process of image segregation and formation. The results encourage the use of spatial frequency metrics for prediction of human performance.
Author (GRA)

N81-28110# Hercules Powder Co., Cumberland, Md. Ballistics Lab.

SAFETY ANALYSIS OF THE 700-HORSEPOWER COMBUSTION TEST FACILITY

B. D. Berkey May 1981 57 p refs
(Contract DE-AC22-80PC-30198)
(DOE/PC-30198/T4; HERC-81-25) Avail: NTIS HC A04/MF A01

A safety analysis is provided of the 700 h.p. Combustion Test Facility located in the Pittsburgh Energy Technology Center. Safety related measures were incorporated into the design, construction, and operation of the Combustion Test Facility. These include: nitrogen addition to the coal storage bin, slurry hopper, roller mill and pulverizer baghouse; use of low oxygen content combustion gas for coal conveying; an oxygen analyzer for the combustion gas; insulation on hot surfaces; proper classification of electrical equipment; process monitoring instrumentation and planned remote television monitoring system. Analysis of the system considering these factors resulted in the determination of overall probabilities of occurrence of hazards. The identified hazards include coal dust ignition by hot ductwork and equipment, loss of inerting within the coal conveying system leading to a coal dust fire, and ignition of hydrocarbon vapors spilled oil, or slurry.
DOE

N81-28111# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

FROM THE CIVIL COMPONENT PROGRAM 'IFAS': FUNDAMENTALS OF ENGINE SIMULATION, USING TURBOPOWERED SIMULATOR (TPS) TECHNOLOGY IN WIND TUNNEL TESTS Final Report

Wolfgang Burgsmueller Bonn Bundesministerium fuer Forschung

und Technologie Dec. 1980 49 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-030; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Basic information about engine simulation in a wind tunnel is presented. The so-called TPS technology is defined, and test arrangements along with methods of operation are described. Under which conditions the TPS approach is most efficient is considered and comparison with other types of engine simulators is made. The test procedure, using a TPS in a wind tunnel is specified as to inputs, data acquisition, and data reduction. The TPS calibration method is given, including setup of the calibration chamber and derivation of the relevant thermodynamic formulas. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-28112*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS PROCESSING IN SPACE: A SURVEY OF REFERRED OPEN LITERATURE PUBLICATIONS
E. Pentecost, comp. (Universities Space Research Association, Boulder, Colo.) Jul. 1981 54 p refs
(NASA-TM-82425) Avail: NTIS HC A04/MF A01 CSCL 22A

Over 190 reports published in the open literature by workers in the materials processing in space program are listed according to year as well as alphabetically by author. Thirty five reports submitted for publication are also cited. Supported either directly or indirectly by NASA, the research generally pertains to the influence (or lack of influence) of gravity on processes involved in crystal growth, solidification, fluid transport, containerless phenomena, and various separation techniques of interest to the biomedical community. Studies of the possibilities of using the high vacuum in the wake of orbiting vehicles for performing processes involving large heat loads and evolution of gases are also included. A.R.H.

N81-28113*# Rensselaer Polytechnic Inst., Troy, N. Y.
DATA ACQUISITION AND ANALYSIS OF RANGE-FINDING SYSTEMS FOR SPACING CONSTRUCTION Annual Report, 1 May 1980 - 30 Apr. 1981
C. N. Shen 1981 52 p refs
(Grant NAG1-61)
(RPI-TR-MP-81; NASA-CR-164643) Avail: NTIS HC A04/MF A01 CSCL 22A

For space missions of future, completely autonomous robotic machines will be required to free astronauts from routine chores of equipment maintenance, servicing of faulty systems, etc. and to extend human capabilities in hazardous environments full of cosmic and other harmful radiations. In places of high radiation and uncontrollable ambient illuminatins, T.V. camera based vision systems cannot work effectively. However, a vision system utilizing directly measured range information with a time of flight laser rangefinder, can successfully operate under these environments. Such a system will be independent of proper illumination conditions and the interfering effects of intense radiation of all kinds will be eliminated by the tuned input of the laser instrument. Processing the range data according to certain decision, stochastic estimation and heuristic schemes, the laser based vision system will recognize known objects and thus provide sufficient information to the robot's control system which can develop strategies for various objectives. Author

N81-28114# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
SPACELAB PROGRAM: SYSTEM ENGINEERING, MANAGEMENT AND STATUS [SPACELAB PROGRAMM-SYSTEMTECHNIK-MANAGEMENT UND STATUS]
Ants Kutzer 1980 56 p refs In GERMAN Presented at 29th Raumfahrtkongr. der Hermann-Oberth-Ges. e.V., Feucht, West Germany, 25-29 Jun. 1980
(ERNO-309) Avail: NTIS HC A04/MF A01

Systems design and construction as part of the Spacelab program are described. Systems development management which uses modular configurations to optimize for Spacelab system reliability, versatility and reusability is assessed. Technological development in spaceflight principals and methods are reviewed, covering the 60's in the U.S. along with the later impact of NASA projects on European space programs. The results obtained from spaceflight certification and checkout investigations on the Spacelab system are presented. The interface between a complex control system and system elements is explained. Project management experience in system management techniques provides a methodological model useful in planning and implementing future spaceborne systems. Author (ESA)

N81-28115# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE, NO. 9
2 Mar. 1981 50 p refs Transl. into ENGLISH from various Russian publications
(JPRS-77488) Copyright. Avail: NTIS HC A03/MF A01

Spacecraft, missions, crew training, spacecraft life support systems, agrometeorology, space achievements, and space plans are discussed. For individual titles, see N81-28116 through N81-28123.

N81-28116# Joint Publications Research Service, Arlington, Va.
CHRONOLOGY OF SOYUZ T-3 MISSION
In its USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 1-2 Transl. into ENGLISH from Soviet News Agency TASS (USSR), 1980 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

The mission was to test the spacecraft in autonomous flight and in joint operation with the Salyut 6/Progress 11 complex. A brief chronology of the fight from launch to descent is presented. The crew work program included the testing of the Soyuz T-3, checkout of the Salyut 6 station, and performance of maintenance and repairs. The development of plants in a hothouse was studied, a Splav unit was used to attempt manufacture of a cadmium-mercury-tellurium semiconductor compound, and two experiments were performed on a Kristall furnace to obtain a gallium-bismuth semiconductor material. An orbital correction maneuver was made. The orbital parameters of the Salyut 6/Soyuz T complex are given. Repairs made on the Salyut 6 are listed. J.D.H.

N81-28117# Joint Publications Research Service, Arlington, Va.
SOVIET COSMONAUT TRAINING CENTER REVIEWED **c14**
Yu. A. Gagarin *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 3-7 Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 5, 1980 p 15-19 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

The evolution of cosmonaut training procedures is surveyed, and present training methods reviewed. Preflight training to facilitate cosmonaut readaptation from weightlessness to gravity is an important addition to the training. General space training of groups of trainees is described. Direct training is performed with crews formed for each flight for a specific spacecraft. The developers of various systems and procedure engineers assist crews in training sessions and tests of the spacecraft. The procedures for performance research experiments included in the flight program, particularly remote sensing of the earth, are part of the direct phase of training. Weightlessness is simulated in a hydraulic lab and in the Llyushin-3 laboratory aircraft. G-loads are centrifugally created. Training is also performed in the space planetarium and in simultaneously operated space trainers. J.D.H.

N81-28118# Joint Publications Research Service, Arlington, Va.
EVOLUTION OF THE SOYUZ SPACECRAFT **c18**
Yu. Malyshev *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 8-13 Transl. into ENGLISH from Aviat.

Kosmonavt. (USSR), no. 10, 1980 p 38-39 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

Changes in improvements in the Soyuz series spacecraft are reviewed. The same fuel fed from common tanks is now used for both the main propulsion engine and the orientation and docking engine. Crew quarters are jettisoned in orbit. Solar cells in the two wings are included in the electrical power supply system of the orbital complex. Soft-landing engines are located on the bottom of the reentry vehicle. An onboard computer complex handles programmed turns and settings for switching on the main propulsion engines and docking orientation engines. The onboard computer display simultaneously makes position information available to the crew and to ground support facilities. Semiconductor integrated circuits and miniaturized electronic devices are used in the orientation and motion control system. Unmanned flight tests and the manned flight and maneuvering of the Soyuz T are reviewed. J.D.H.

N81-28119# Joint Publications Research Service, Arlington, Va.
LIFE SUPPORT SYSTEMS FOR MANNED SPACEFLIGHT c18
B. A. Adaovich *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 17-25 Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 6, Nov. - Dec. 1980 p 20-25 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

The requirements of a life support system are reviewed, and the life support system aboard the Salyut 6 is discussed. The material balance needed by a spacecraft crew is presented. Production and preservation of regenerated drinking water is described. An experimental system of regenerating drinkable water from atmospheric moisture using ion exchange resins and activated charcoal is described. Vacuum dried foods, the spacecraft shower, oxygen regeneration systems, and the handling of wastes are discussed. A schematic diagram of a closed, ecological life support system is presented. The hydroponic space greenhouse tested on Cosmos 1129 is described. Production of 400 g of dry biomass daily from one square meter of growing surface in the Samorod device is described. J.D.H.

N81-28120# Joint Publications Research Service, Arlington, Va.
USE OF SATELLITE PICTURES FOR AGRICULTURE c43
D. Gergishvili *In its* USSR Rept.: Space, No. 9 (JPRS-77388) 2 Mar. 1981 p 26-27 refs Transl. into ENGLISH from Komunisti (USSR), 24 Jul. 1980 p 4 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

The functions of the hydrometeorological station in Telavi, Soviet Georgia, are described. Agroclimatic conditions affecting the grape crop are monitored to provide protection against natural hazards. Weather forecasts are produced, aerological, agrometeorological, hydrological, and meteorological data are collected, and environmental pollution monitored. The use of weather satellite data has improved their forecasting ability by 3.2 percent, and the accuracy of hail forecasting by 3.7 percent. J.D.H.

N81-28121# Joint Publications Research Service, Arlington, Va.
PETROV REVIEWS SOVIET SPACE ACHIEVEMENTS
B. Petrov *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 32-36 Transl. into ENGLISH from Aviat. Kosmonovt. (USSR), no. 9, 1980 p 36-37 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

The Russian space program is reviewed, space missions summarized, and plans for increased attention to the applied areas of space research are discussed. Satellite communications, broadcasting, television, and remote sensing systems are described. Planned programs for international cooperation are discussed and the status of various programs described. J.D.H.

N81-28122# Joint Publications Research Service, Arlington, Va.
THE PENTAGONS DANGEROUS PLANS FOR SPACE c18
P. Plyachenko *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 39-41 Transl. into ENGLISH from Sov. Voin (USSR), no. 24, 1980 p 44-45 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

Information from American publications on military uses of space is discussed. Manned military observation satellites, the identification and destruction of foreign objects in space, silent satellites, laser weapons, orbiting armed missiles, and military reconnaissance satellites are discussed. J.D.H.

N81-28123# Joint Publications Research Service, Arlington, Va.
LIST OF RECENT SOVIET SPACE LAUNCHES
In its USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 42-43 Transl. into ENGLISH from Soviet News Agency TASS (USSR), 1981 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

Eleven space launches between November 21, 1980 and December 26, 1980 are listed. Orbital parameters given for all but the Soyuz T-3 are apogee, perigee, period, and inclination. The missions of the Prognoz 8 and the Ekran communications satellite are given. J.D.H.

N81-28723# Joint Publications Research Service, Arlington, Va.
THE FIRST MANNED SPACE FLIGHT
O. G. Gazenko, A. M. Genin, N. N. Gurovskiy, and A. R. Kotovskaya *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 1-4 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 5, no. 2, Mar. - Apr. 1981 p 5-7 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N81-28117# Joint Publications Research Service, Arlington, Va.
SOVIET COSMONAUT TRAINING CENTER REVIEWED
Yu. A. Gagarin *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 3-7 Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 5, 1980 p 15-19 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-28124 Columbia Univ., New York.
MULTIPLE ACCESS STUDIES OF MULTIBEAM COM-

MUNICATION SATELLITES Ph.D. Thesis
Jayant Ganesh Garde 1981 152 p
Avail: Univ. Microfilms Order No. 8113507

The next generations of communications satellites are expected to employ satellite switched multiple spot beams to increase the system. The use of multiple spot beam systems in a packet switched environment with a large number of small bursty users is studied. A system is considered which achieves frequency reuse by using sub 2 nonoverlapping spot beams with sub T frequency translating transponders, where N sub T < or = N sub 2. Promising system architecture are studied and six multiple access protocols are proposed to provide for the efficient use of the satellite channel; i.e., to reduce average packet delays while maintaining high throughput. Three of the protocol are based on a fixed switching sequence: the first uses a fixed station access technique, the second uses demand assigned station access and the third has a random station access. In the next protocol, station access slots and switch settings are both assigned on demand, on a packet by packet basis. The last two protocols assume buffering on board the satellite and the satellite operating as a store and forward node.
Dissert. Abstr.

N81-28125* National Aeronautics and Space Administration, Washington, D. C.
NASA LAUNCHES DUAL DYNAMICS EXPLORER SPACECRAFT
4 Aug. 1981 2 p
(NASA-News-Release-81-114; P81-10115) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

A Delta launch vehicle was used to insert Dynamics Explorer A into a highly elliptical polar orbit, ranging from 675 to 24,945 km, and Dynamics Explorer B satellite into a low polar orbit, ranging from 306 to 1,300 km. The two spacecraft are designed to provide specific knowledge about the interaction of energy, electric currents, electric fields, and plasmas between the magnetosphere, the ionosphere, and the atmosphere. A.R.H.

N81-28126* National Aeronautics and Space Administration, Washington, D. C.
PIONEER 10 AT SILVER AU DESCRIBES SUN'S ATMOSPHERE
3 Aug. 1981 8 p
(NASA-News-Release-81-110; P81-10111) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

Almost 4 billion kilometers from the Sun, Pioneer 10's findings paint a detailed picture of the solar atmosphere. The heliosphere is now believed to be a huge magnetic bubble created by the solar wind and gets its tear-shape from streamlining due to the motion of the solar system through the interstellar gas. The skin of the bubble, the region between stellar and interstellar gas, is believed to lie between 50 and 100 AU from the Sun. The solar wind drags the Sun's magnetic field with it. The bubble, probably extends far beyond Pluto, and is believed to breathe, expanding and contracting like a giant cosmic lung with each 11 year cycle. The most recent findings show that as storms on the Sun build up toward maximum solar activity, they send out shock waves throughout the bubble which cause ripples. This long lived solar storm turbulence accelerates low energy cosmic ray particles coming in from the galaxy, deflecting them out of the solar system, and shielding the planets. As distance from the Sun increases, more and more cosmic ray particles penetrate the heliosphere. A.R.H.

N81-28127*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS EXPLORER LAUNCH
[1981] 34 p
(NASA-TM-82292; S-850-81-03) Avail: NTIS HC A03/MF A01 CSCL 22B

Simultaneously launched from the WSMC, two satellites are to be placed into polar, copolar orbit in order to acquire data on the coupling phenomena between Earth's lower thermosphere and the magnetosphere, as part of the Solar-Terrestrial Program. The mission sequence, instruments, and science data processing system are described as well as the characteristics of the Delta 3913 launch vehicle, and payload separation staging. A.R.H.

N81-28128*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATION OF ELECTRODYNAMIC STABILIZATION AND CONTROL OF LONG ORBITING TETHERS Interim Report, 1 Sep. 1979 - 28 Feb. 1981
D. A. Arnold and M. Dobrowolny 28 Feb. 1981 84 p refs (Contract NAS8-33691)
(NASA-CR-161826) Avail: NTIS HC A05/MF A01 CSCL 22B

An algorithm for using electric currents to control pendular oscillations induced by various perturbing forces on the Skyhook wire is considered. Transverse and vertical forces on the tether; tether instability modes and causes during retrieval by space shuttle; simple and spherical pendulum motion and vector damping; and current generation and control are discussed. A computer program for numerical integration of the in-plane and out-of-plane displacements of the tether vs time was developed for heuristic study. Some techniques for controlling instabilities during payload retrieval and methods for employing the tether for launching satellites from the space shuttle are considered. Derivations and analyses of a general nature used in all of the areas studied are included. A.R.H.

N81-28129*# National Aeronautics and Space Administration, Washington, D. C.
VOYAGER PROGRAM: VOYAGER 2 ENCOUNTER AT SATURN
26 Aug. 1981 50 p
(NASA-TM-82293; MOR-S-802-77-01/02) Avail: NTIS HC A03/MF A01 CSCL 22B

The planned sequence of events for the encounter are presented. The current status of the Voyager flight and ground systems, and the mission success criteria are summarized. Key Voyager team members are identified. Changes to the plan described may be expected due to trajectory updates and interations on the sequence design as the mission progresses.
T.M.

N81-28130*# National Aeronautics and Space Administration, Washington, D. C.
FLTSATCOM-E LAUNCH
4 Aug. 1981 22 p
(NASA-TM-80463; MOR-0-491-202-81-05) Avail: NTIS HC A02/MF A01 CSCL 22B

The Atlas SLV-3D/Centaur D-LA launch vehicle configuration chosen to launch the last of a series of Fleet Satellite Communications System satellites into a transfer orbit from which the spacecraft's apogee motor which will inject the satellite into a synchronous orbit is discussed. The mission and satellite are described. The spacecraft provides 23 UHF and one SHF communication channels for narrowband and wideband communication for the United States Navy and Air Force. A.R.H.

N81-28131# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STABILITY ANALYSIS OF GRAVITY GRADIENT STABILIZED SATELLITE CONTAINING A FLEXIBLE BEAM
Santiago Alves Tavares and Paulo Tadeu deMello Lourencao May 1981 12 p refs Proposed for presentation at the 6th Congr. Brasileiro de Eng. Mecan., Rio de Janeiro, 15-18 Dec. 1981
(INPE-2078-RPE/313) Avail: NTIS HC A02/MF A01

The dynamic stability study of a gravity oriented flexible satellite is presented. The Lagrangian formulation for obtaining the equations of motion and the direct Liapunov method for the determination of sufficient stability conditions were used. Rayleigh quotient properties for evaluating the elastic potential energy and Schewartz inequality for obtaining the integral coordinates were used for simplifying the solution of the problem. Stability diagrams are plotted and analyzed. Author

N81-28132*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAUNCH MISSION SUMMARY. SBS-B DELTA-158
3 Aug. 1981 32 p

(NASA-TM-80460; KSC-GP-15-20) Avail: NTIS HC A03/MF A01 CSCL 22B

Included is information relative to launch windows, vehicle telemetry coverage, real time data flow, telemetry coverage by station, selected trajectory information, and a brief sequence of flight events. S.F.

N81-28133# Air Force Geophysics Lab., Hanscom AFB, Mass.
ARIES ROCKET FLIGHT VIBRATION TEM-2 MULTISPECTRAL MEASUREMENTS PROGRAM
Russell G. Steeves 8 Dec. 1980 14 p refs
(AF Proj. 7659)
(AD-A100272; AFGL-TR-80-0364; AFGL-IP-296) Avail: NTIS HC A02/MF A01 CSCL 22/2

An in-flight vibration measurement was made on the second Aries rocket launch of a series. The data are analyzed and presented in this paper. Results here validate those obtained in the first test and confirm that the Aries has a very mild vibration environment. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-28134* National Aeronautics and Space Administration, Washington, D. C.
FIRST REUSABLE SPACESHIP PREPARED FOR SECOND MISSION
27 Jul. 1981 8 p
(NASA-News-Release-81-99; P81-10100) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

The inspection, repair, and modification of the space shuttle Columbia prior vehicle assembly and roll out for the second space transportation system flight are described. The schedule for launch countdown and a preliminary sketch of plans for the second flight are presented. A.R.H.

N81-28135*# National Aeronautics and Space Administration, Washington, D. C.
THE SHUTTLE ERA
[1981] 8 p
(NASA-TM-80455; NASA-Facts-127/3-81) Avail: NTIS HC A02/MF A01 CSCL 22B

An overview of the Space Shuttle Program is presented. The missions of the space shuttle orbiters, the boosters and main engine, and experimental equipment are described. Crew and passenger accommodations are discussed as well as the shuttle management teams. T.M.

N81-28122# Joint Publications Research Service, Arlington, Va.
THE PENTAGONS DANGEROUS PLANS FOR SPACE
P. Plyachenko *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 39-41 Transl. into ENGLISH from Sov. Voin (USSR), no. 24, 1980 p 44-45 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-28136*# Systems Science and Software, La Jolla, Calif.
ADDITIONAL APPLICATION OF THE NASCAP CODE. VOLUME 1: NASCAP EXTENSION Final Report, Mar. 1979 - Oct. 1980
I. Katz, J. J. Cassidy, M. J. Mandell, D. E. Parks, G. W. Schnuelle, P. R. Stannard, and P. G. Steen Feb. 1981 126 p refs 2 Vol.
(Contract NAS3-21762)
(NASA-CR-165349; SSS-R-81-4847-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 22B

The NASCAP computer program comprehensively analyzes problems of spacecraft charging. Using a fully three dimensional approach, it can accurately predict spacecraft potentials under a variety of conditions. Several changes were made to NASCAP, and a new code, NASCAP/LEO, was developed. In addition, detailed studies of several spacecraft-environmental interactions and of the SCATHA spacecraft were performed. The NASCAP/LEO program handles situations of relatively short Debye length encountered by large space structures or by any satellite in low earth orbit (LEO). T.M.

N81-28118# Joint Publications Research Service, Arlington, Va.
EVOLUTION OF THE SOYUZ SPACECRAFT
Yu. Malyshev *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 8-13 Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 10, 1980 p 38-39 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

N81-28119# Joint Publications Research Service, Arlington, Va.
LIFE SUPPORT SYSTEMS FOR MANNED SPACEFLIGHT
B. A. Adaovich *In its* USSR Rept.: Space, No. 9 (JPRS-77488) 2 Mar. 1981 p 17-25 Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 6, Nov. - Dec. 1980 p 20-25 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N81-28137*# Research Triangle Inst., Research Triangle Park, N. C.

CONCEPTS FOR ON-BOARD SATELLITE IMAGE REGISTRATION. VOLUME 2: IAS PROTOTYPE PERFORMANCE EVALUATION STANDARD DEFINITION Final Report, 23 May - 15 Dec. 1980

D. R. Daluge and W. H. Ruedger Jun. 1981 35 p refs
(Contract NAS1-15768)
(NASA-CR-165734) Avail: NTIS HC A03/MF A01 CSCL 22B

Problems encountered in testing onboard signal processing hardware designed to achieve radiometric and geometric correction of satellite imaging data are considered. These include obtaining representative image and ancillary data for simulation and the transfer and storage of a large quantity of image data at very high speed. The high resolution, high speed preprocessing of LANDSAT-D imagery is considered. A.R.H.

N81-28138*# Research Triangle Inst., Research Triangle Park, N. C.

CONCEPTS FOR ON-BOARD SATELLITE IMAGE REGISTRATION. VOLUME 3: IMPACT OF VLSI/VHSIC ON SATELLITE ON-BOARD SIGNAL PROCESSING Final Report, 23 May - 15 Dec. 1980

J. V. Aanstoos and W. E. Snyder (North Carolina State Univ., Raleigh) Jul. 1981 59 p refs
(Contract NAS1-15768)
(NASA-CR-165735) Avail: NTIS HC A04/MF A01 CSCL 22B

Anticipated major advances in integrated circuit technology in the near future are described as well as their impact on satellite onboard signal processing systems. Dramatic improvements in chip density, speed, power consumption, and system reliability are expected from very large scale integration. Improvements are expected from very large scale integration enable more intelligence to be placed on remote sensing platforms in space, meeting the goals of NASA's information adaptive system concept, a major component of the NASA End-to-End Data System program. A forecast of VLSI technological advances is presented, including a description of the Defense Department's very high speed integrated circuit program, a seven-year research and development effort. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-28139* Martin Marietta Aerospace, Denver, Colo.

LOW THRUST CHEMICAL ORBIT TO ORBIT PROPULSION SYSTEM PROPELLANT MANAGEMENT STUDY Progress Report, Sep. 1979 - Jan. 1981

R. H. Dergance, K. M. Hamlyn, and J. R. Tegart Jun. 1981 214 p refs
(Contract NAS3-21954)
(NASA-CR-165293; MCR-81-503) Avail: NTIS HC A10/MF A01 CSCL 21H

Low thrust chemical propulsion systems were sized for transfer of large space systems from LEO to GEO. The influence of propellant combination, tankage and insulation requirements, and propellant management techniques on the LTPS mass and volume were studied. Liquid oxygen combined with hydrogen, methane or kerosene were the propellant combinations. Thrust levels of 445, 2230, and 4450 N were combined with 1, 4 and 8 perigee burn strategies. This matrix of systems was evaluated using multilayer insulation and spray-on-foam insulation systems. Various combinations of toroidal, cylindrical with ellipsoidal domes, and ellipsoidal tank shapes were investigated. Results indicate that low thrust (445 N) and single perigee burn approaches are considerably less efficient than the higher thrust level and multiple burn strategies. A modified propellant settling approach minimized propellant residuals and decreased system complexity, in addition, the toroid/ellipsoidal tank combination was predicted to be shortest. A.R.H.

N81-28140*# Systems Science and Software, La Jolla, Calif.

ADDITIONAL APPLICATION OF THE NASCAP CODE. VOLUME 2: SEPS, ION THRUSTER NEUTRALIZATION AND ELECTROSTATIC ANTENNA MODEL Final Report, Mar. 1979 - Oct. 1980

I. Katz, J. J. Cassidy, M. J. Mandell, D. E. Parks, G. W. Schnuelle, P. R. Stannard, and P. G. Steen Feb. 1981 106 p refs 2 Vol.
(Contract NAS3-21762)
(NASA-CR-165350; SSS-R-81-4847-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 21C

The interactions of spacecraft systems with the surrounding plasma environment were studied analytically for three cases of current interest: calculating the impact of spacecraft generated plasmas on the main power system of a baseline solar electric propulsion stage (SEPS), modeling the physics of the neutralization of an ion thruster beam by a plasma bridge, and examining the physical and electrical effects of orbital ambient plasmas on the operation of an electrostatically controlled membrane mirror. In order to perform these studies, the NASA charging analyzer program (NASCAP) was used as well as several other computer models and analytical estimates. The main result of the SEPS study was to show how charge exchange ion expansion can create a conducting channel between the thrusters and the solar arrays. A fluid-like model was able to predict plasma potentials and temperatures measured near the main beam of an ion thruster and in the vicinity of a hollow cathode neutralizer. Power losses due to plasma currents were shown to be substantial for several proposed electrostatic antenna designs. A.R.H.

N81-28141# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.

POST BURNOUT THRUST MEASUREMENTS Final Report

Edward F. McKenna 13 Jan. 1981 17 p refs
(AF Proj. 7659)
(AD-A100267; AFGL-TR-81-0006; AFGL-IP-297) Avail: NTIS HC A02/MF A01 CSCL 21/8

Research has been conducted into the problems of avoiding collision between separated payloads and spent rocket motors due to post burnout thrust and into the problem of contamination of scientific instrumentation due to outgassing of the smoldering insulation. In order to measure this post burnout thrust, a payload instrument module was separated from an instrumented Black Brant VC Rocket in the exoatmosphere. In addition to measuring accelerations and velocities, the spent motor was observed by a TV camera on board the command attitude controlled payload module. Analysis shows that the payload separated cleanly from the vehicle at a relative separation velocity of 2.25 ft/sec (0.69 m/sec). However, the residual thrust of the spent motor overcame this differential, catching up to the payload 37 sec after separation and continuing on a parallel velocity vector at about 3.37 ft/sec (1.03 m/sec). Author (GRA)

N81-28142# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

EXTERNAL BURNING PROPULSION ANALYSIS (EBPA). USER'S MANUAL Progress Report, 20 Sep. 1979 - 15 Dec. 1980

J. C. Davis and D. W. Harvey Apr. 1981 79 p
(Contract F04611-79-C-0046; AF Proj. 5730)
(AD-A101185; MDC-G9474; AFRPL-TR-81-05) Avail: NTIS HC A05/MF A01 CSCL 21/8

This user's manual provides instructions to initiate, run, and terminate the External Burning Propulsion Analysis (EBPA) computer program. Details are given of inputs, processing flow, instructions for use, outputs (including loadsheets for sample case), operating messages, troubleshooting, and requisite hardware and support software. The program was developed for operation on the CDC 6400/7600 and CYBER 174 computing systems, but its machine dependency has been minimized. The EBPA program is self-contained and requires no communication with outside programs. In addition to the program tape, a single chemistry data tape is required for its operation. Author (GRA)

N81-28143# Los Alamos Scientific Lab., N. Mex.
REACTORS FOR NUCLEAR ELECTRIC PROPULSION
D. Buden and Joseph A. Angelo, Jr. 1981 12 p refs Presented at the 15th AIAA/JSASS/DGLR Intern. Electromagnetic Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-81-703; CONF-810439-2) Avail: NTIS HC A02/MF A01

The role of nuclear fission reactors as the primary power source for high specific impulse electric propulsion systems for space missions of the 1980s and 1990s is examined. Particular mission applications include transfer to and a reusable orbital transfer vehicle from low-Earth orbit to geosynchronous orbit, outer planet exploration and reconnaissance missions, and as a versatile space tug supporting lunar resource development. Nuclear electric propulsion is examined as an indispensable component in space activities of the next two decades. DOE

N81-28144# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.
SECONDARY COMBUSTION IN ROCKET PLUMES: A THEORETICAL APPROACH
D. Brian Spalding Jul. 1979 36 p refs
(HTS/79/5) Avail: NTIS HC A03/MF A01

The problem of predicting the circumstances governing the appearance of secondary combustion in rocket exhaust plumes is examined. A mechanism is postulated in which the reactants are brought as interleaved folds which stretch as they travel downstream. Coherence and interdiffusion of the materials in the fold are assumed. This process can be computed in a reference frame moving with the fold. The equations resulting from the theory and a computer program which solves them are discussed. It is possible by this procedure to predict the chemical transformations and chemical composition at any downstream location. Given the present understanding it is still necessary to guess the sizes of the folds at initiation but at no point in the theory is it necessary to neglect any chemical kinetic principle.
Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-28145 British Library Lending Div., Boston Spa (England).
CHEMILUMINESCENT ANALYSIS IN BIOCHEMISTRY
D. Slawinska and J. Slawinska Jan. 1981 42 p refs Transl. into ENGLISH from Postepy Biochem. (Poland), v. 23, no. 3, 1977 p 445-473
(BLL-RTS-11993) Avail: British Library Lending Div., Boston Spa, England

A review of bioluminescent and chemiluminescent analytical techniques of interest to biochemists is presented. The kinetics of both types of reactions are discussed. E.D.K.

N81-28146# American Chemical Society, Springfield, Va. Div. of Industrial and Engineering Chemistry.
THE 16TH NATIONAL SYMPOSIUM ON POLYMERS IS THE SERVICE OF MAN Final Report
Robert S. Shane (Shane Associates, Inc., Springfield, Va.) 1980 194 p refs Symp. held in Washington, D.C., 9-11 Jun. 1980; sponsored by Carnegie Inst. Sponsored in part by NRL
(Grant AF-AFOSR-00222-80; AF Proj. 2303)
(AD-A096998; AFOSR-81-0159TR) Avail: NTIS HC A09/MF A01 CSCL 07/3

An overview session traced polymer development in the U.S., presented the status of polymer science in Europe and Japan, and addressed the role of polymers in meeting energy problems. Topics concerning engineering plastics, conventional fibers, high performance fibers, composites, and coatings are discussed. For individual titles, see N81-28147 through N81-28171.

N81-28147# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
DEFINITION AND DESCRIPTION OF ENGINEERING PLASTICS BUSINESS Final Report c27
Glen A. Thommes *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 8-11
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Engineering plastics are those high performance resins which tend to replace nonplastics materials, often metal, in durable goods. Major emphasis is placed on the factors driving the growth of engineering plastics in today's climate. For example, the tight energy supply; engineering plastics require less energy than metals to produce, and also often save energy in their end uses. A second factor is a favorable cost position vs. die cast metals. Another factor is the broad range of materials available today, each with unique combinations of properties. Finally, designers have demonstrated increasing ability to use the special properties of engineering plastics to eliminate parts, save costs, and provide durable goods products that are unique. E.D.K.

N81-28148# General Motors Research Labs., Warren, Mich. Polymers Dept.
TRANSPORTATION AND ENGINEERING PLASTICS Final Report c27
Philip Weiss *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 13-15 refs
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Engineering plastics, such as thermoplastic polyesters, filled nylons, polycarbonate, and sheet molding compounds are used in the automotive industry. Specific applications including processing methods are presented. For effective utilization of engineering plastics, there must be a balance between properties (physical, chemical, etc.), rapid processing, environmental and safety considerations, and cost advantages over components fabricated from steel, aluminum, and other polymeric materials. Selection of an engineering plastic for a given application, particularly for the exterior of the automobile, must also be impact resistant and provide the required surface characteristics for painting. E.D.K.

N81-28149# Bell Telephone Labs., Inc., Murray Hill, N. J.
GRAMS TO TONS (PLASTICS IN COMMUNICATIONS) c27
L. D. Loan *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 16-17 refs
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

As in many other industries, the use of polymers in the communications industry has increased year by year. Although most of these polymeric materials are used in what one might call bulk applications such as wire insulation and plastic equipment housings increasing amounts are being used in much more specific and perhaps demanding applications. A spectrum of these applications together with a snapshot view of the most important chemical requirements in each case is presented. E.D.K.

N81-28150# Akron Univ., Ohio. Inst. of Polymer Science.
THE FUTURE OF ENGINEERING PLASTICS Final Report c27
F. N. Kelley *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 21-26 refs
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Forecasts of the wider use of polymers as engineering materials in structures are examined in light of trend extrapolations as well as the constraints imposed by shrinking supplies of materials, capital, and energy. A favorable projection emerges related to the opportunities generated by needs for light weight materials in transportation and other energy dominated fields. Some major deficiencies in design know-how on the optimum use of plastics and resin based composites are described, which may produce a large damping effect on optimistic projections. In addition, several developments in polymer structures specifically designed for processability and engineering use, including molecular composites, are discussed. Author

N81-28151# ITT Rayonier, Inc., Stamford, Conn.
NEW HORIZONS FOR CELLULOSICS c27

H. L. Hergert *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 27-31 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

There is a resurgence of interest in cellulose as a substitute for oil based products. Recent commercial fiber developments have centered on high wet modulus rayons with crimp or modified cross sections to improve textile opacity and hand, hollow rayon fibers for dianalysis applications, and absorptive rayons modified by grafting or incorporation of carboxyl containing polymers. Anisotropic solution properties offer future promise of improved strength properties of cellulose derivatives. Solvent systems are being studied to provide totally enclosed systems for regenerating cellulose without the effluent or emission problems experienced in the viscose or cuprammonium processes. E.D.K.

N81-28152# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.
MODIFICATION OF FIBERS BY RADIATION GRAFTING Final Report c27
Vivian T. Stannett *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 32-34 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Both surface and bulk properties of fibers can be modified by radiation grafting. Surface improvements which can be imparted by grafting include abrasion, anti-static properties, wettability and adhesion, water repellancy, and crease resistance. Bulk properties, or deeper ring grafting can impart greater water sorption, flame retardancy, and changes in the mechanical behavior. The high order (orientation, crystallinity) of textile fibers make it more difficult to impart bulk property changes. Methods to overcome this problem which can lead to super-water absorbency and elasticity are described. Methods of localizing the grafting are discussed. E.D.K.

N81-28153# Monsanto Textiles Co., Pensacola, Fla.
FORTY YEARS OF MELT SPINNING Final Report c27
F. S. Riordan, Jr. and J. H. Saunders (Monsanto Textiles Co., Pensacola, Fla.) *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 35-43 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The age of truly synthetic textile fibers began in October 1939 with the commercial production of nylon in the Seaford (Delaware) plant of the DuPont Company. It is possibly not fully appreciated that to make nylon into textile yarns and fibers required the development of a totally different technology: melt spinning. Nylon was joined by polyester in the early 1950's and by polypropylene in the early 1960's. World wide capacity for these three fibers is close to 25 billion pounds per year, an increase of over 800 times the 30 million pound per year capacity of the Seaford plant. E.D.K.

N81-28154# Allied Chemical Corp., Morristown, N.J.
RECENT DEVELOPMENTS IN THE OPTIMIZATION OF A MELT SPINNING PROCESS Final Report c27
Dusan C. Preevorsek and Young D. Kwon *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 44-52 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Analytical techniques which greatly facilitate the optimization of a melt spinning process are reviewed. The method is based on the findings that: (1) the temperature and deformation rate histories of the fiber in the spinning and drawing steps control the quality and properties of the final product and (2) the digital simulation of the process can be used to match filament temperature and deformation histories when process rates, spinnerette, and quench stack designs are changed. An example of process optimization is presented with respect to fiber strength and the origin of perturbation is discussed which affect adversely the filament and yarn properties. E.D.K.

N81-28155# Union Carbide Corp., Parma, Ohio.
CARBON FIBERS Final Report c24
Roger Bacon *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 54-57 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The primary use of carbon fibers is in reinforcement of plastics. Property advantages over conventionally reinforced or unreinforced plastics include: high mechanical stiffness, low density, low thermal expansion, good thermal stability, and electrical conductivity. Properties of the composite are strongly affected by the major physical and chemical properties of the fiber which can be varied over wide ranges; in some cases, more than an order of magnitude. These properties are determined by three key fiber parameters; carbon content, crystallinity, and preferred orientation. The important process variables controlling these parameters are described for each of the major carbon fiber processes, using rayon, polyacrylonitrile, and mesophase pitch as precursors. E.D.K.

N81-28156# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
EXTENDED CHAIN AROMATIC POLYMERS Final Report c27
J. A. Fitzgerald *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 58-67 refs (For primary document see N81-28146 19-24)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Aromatic polyamides based on p oriented diamine and dibasic acid intermediates yield liquid crystalline solutions in amide and acid solvents. These liquid crystalline solutions are composed of highly ordered domains containing extended chains. The overall orientation of these domains is random at rest. When shear is applied to these solutions, the domains assume a common orientation along shear direction. On spinning, these solutions give directly highly oriented, high tenacity, high modulus fibers. The level of properties in the as spun yarn stems from the high degree of alignment of rigid polymer chains. Critical parameters influencing the liquid crystalline state include polymer structure, molecular weight, molecular weight distribution, solvent/polymer interaction, solution concentration and temperature. Author

N81-28157# Monsanto Textiles Co., Pensacola, Fla.
POLYAMIDE-HYDRAZIDE AND COPOLYHYDRAZIDE FIBERS Final Report c27
W. Bruce Black *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 70-77 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Polyamide hydrazides and copolyhydrazides based on paraoriented aromatic ring systems have shown a remarkable propensity for yielding high modulus/high strength fibers useful for application in rigid and flexible composite structures. Interest in paraoriented hydrazide linked polymers is largely in the substantial increase in solubility afforded by the hydrazide linkage over that of structurally comparable wholly amide linked polymers. This increased solubility of hydrazide linked polymers permits high modulus fibers to be spun directly from solutions of the polymers in the organic solvents in which they are polymerized. Yarn Young's moduli up to 106 GPa were obtained for fibers spun from a polyamide hydrazide, and yarn strengths up to 2.7 GPa were obtained for a copolyhydrazide fiber. The performance of the copolyhydrazide fiber in belts of radial tires was equal to that of steel wire in regard to treadwear. E.D.K.

N81-28158# Celanese Research Co., Summit, N.J.
FIBERS FROM ANISOTROPIC MELTS Final Report c27
D. R. Wilson and R. S. Jones *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 78-85 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The formation of high strength fibers by solution spinning of lyotropic polyamides has led to substantial research aimed at identifying thermotropic liquid crystalline polymers which can be melt spun to high strength fibers of comparable properties. A variety of thermotropic polymers were identified. Those that were shown to form high strength fibers are mainly polyesters and polyazomethines which contain a significant proportion of liner and planar linkages. Through formation of suitable copolymers, selection of certain aromatic substituents, or copolymerization with some aliphatic components, melt processable thermotropic polymers were obtained. Fibers from some of these polymers

equal or even exceed those of the liquid crystalline polyamides.
Author

N81-28159# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
PROCESSING OF HIGH STRENGTH, HIGH TEMPERATURE POLYMERS Final Report c27
Thaddeus E. Helminiak *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 86-87 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The principal objective of the program is the attainment of mechanical properties for a structural material comparable with those currently obtained from fiber reinforced composites. However, this goal is being sought with materials possessing significantly higher thermal stability and greater environmental resistance than that exhibited by current structural composites and without the use of fiber reinforcement. The principal efforts of this program were concerned with the choice of the macromolecular chemical structure, while concurrent studies, theoretical and experimental, were considering the problems of characterization, evaluation, and processing. E.D.K.

N81-28160# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Textile Fibers Dept.
INORGANIC ALUMINA FIBERS FOR REINFORCEMENT OF METAL CASTINGS Final Report c26
Ashok K. Dhingra *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 88-123 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

An experimental inorganic alumina fiber designated Fiber FP which is spun in the form of flexible continuous multifilament yarns is described. Fiber FP, essentially a 100 percent alpha-A1203 fiber, is inherently stable at elevated temperatures and is compatible with a variety of metal matrix systems. A versatile potentially low cost composite fabrication technique was developed to incorporate 25 to 60 percent volume loading of Fiber FP into metallic matrices forming a strong fiber/matrix bond. For example, magnesium or aluminum castings reinforced with Fiber FP have a modulus greater than steel at a density about one third of steel combined with excellent transverse, compression, and fatigue properties and temperature capability twice that of unreinforced castings. The fiber, composite properties, and potential applications are discussed. E.D.K.

N81-28161*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CARBON-FIBER TECHNOLOGY Final Report c24
C. Frederick Hansen and John A. Parker *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 125-130 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11D

The state of the art of PAN based carbon fiber manufacture and the science of fiber behavior is surveyed. A review is given of the stabilization by oxidation and the subsequent carbonization of fibers, of the apparent structure of fibers deduced from scanning electron microscopy, from X-ray scattering, and from similarities with soft carbons, and of the known relations between fiber properties and heat treatment temperature. A simplified model is invoked to explain the electrical properties of fibers and recent quantum chemical calculations on atomic clusters are used to elucidate some aspects of fiber conductivity. Some effects of intercalation and oxidative modification of finished fibers are summarized. E.D.K.

N81-28162*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED RESIN SYSTEMS FOR GRAPHITE EPOXY COMPOSITES Final Report c24
W. J. Gilwee and A. Jayarajan *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 131-135 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11D

The value of resin/carbon fiber composites as lightweight structures for aircraft and other vehicle applications is dependent on many properties: environmental stability, strength, toughness, resistance to burning, smoke produced when burning, raw material costs, and complexity of processing. A number of woven carbon fiber and epoxy resin composites were made. The epoxy resin was commercially available tetraglycidylmethylene dianiline. In addition, composites were made using epoxy resin modified with amine and carboxyl terminated butadiene acrylonitrile copolymer. Strength and toughness in flexure as well as oxygen index flammability and NBS smoke chamber tests of the composites are reported. E.D.K.

N81-28163# Rockwell International Science Center, Thousand Oaks, Calif.
ADVANCED COMPOSITES FOR AUTOMOTIVE APPLICATION Final Report c24
C. I. Hamermesh *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 137-140 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11/4

For the purpose of this discussion advanced composites are defined as a combination of resins and continuous fiber reinforcement all or part of which is graphite fiber. In attempting to make the transition from the use of these composites in aerospace applications to the automotive industry, the vast differences in regard to both the number of units produced and the premium the manufacturer is willing to pay for weight saved must be recognized. The cost effectiveness of using the composites is discussed. E.D.K.

N81-28164# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPATIAL DISTRIBUTION OF VOLATILE COMPOUNDS IN GRAPHITE COMPOSITES Final Report c24
Michael A. Grayson (McDonnell Douglas Research Labs.), Clarence J. Wolf (McDonnell Douglas Research Labs.), and Demetrius A. Kourtides *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 141-147 refs (For primary document see N81-28146 19-23)
(NASA Order A-67827-B)
Avail: NTIS HC A09/MF A01 CSCL 11D

The distribution of water and other volatile compounds such as acetone and phenol was measured as a function of depth in four graphite resin matrix composites. Precision abrasion mass spectrometry was used to qualitatively and quantitatively characterize the indigenous volatile compounds in the as received condition and after drying in an environmentally controlled oven. The total amount of water in the composites varied from 0.12 wt% to 1.1 wt% and the times required to dry the samples ranged from less than 96 h to much greater than 555 h. E.D.K.

N81-28165# Environmental Protection Agency, Washington, D.C.
TSCA AND THE PAINT AND COATINGS INDUSTRY Final Report c27
Douglas G. Bannerman *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 148-151 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

An inventory of close to 50,000 chemicals currently in commerce in the U.S. was published by EPA and an analytical search is underway to identify those considered hazardous to health or the environment. Chemicals found to pose an unreasonable risk are to be banned controlled in some way. To date control action was taken on polychlorinated biphenyls and chlorofluorocarbons and there are nearterm plans for asbestos. Through its premanufacture notification provisions, TSCA gives EPA the authority to screen chemicals before commercial manufacture or importation begins. Of 150 notices received to date, polymers are the largest single class of substances planned by industry for introduction into commerce. E.D.K.

N81-28166# Du Pont de Nemours (E. I.) and Co., Philadelphia, Pa.
COATINGS FROM ACRYLIC POLYMERS Final Report c27
Werner S. Zimmt *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 152-155 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Since World War II acrylic polymers have become one of

the most important raw materials for the coating industry because of their superior properties and the versatility that they offer. The polymers form brilliantly clear, durable films, which can be varied in hardness of flexibility within wide limits. When acrylic coatings were first introduced they provided an almost unbelievable improvement over most existing film formers; today they provide the standard against which any material is measured. The stability and durability of the acrylic binders has greatly increased the range of colors and pigments that can be used. Bright, transparent colors previously impractical, have become the norm. Coated objects retain their attractive appearance and need recoating less often. Author

N81-28167# Union Carbide Corp., South Charleston, W.Va.
ADVANCES IN LATEX TECHNOLOGY Final Report c27
D. R. Bassett and K. L. Hoy *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 156-161 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Several methods of controlling the emulsion polymer structure to produce desired performance properties are discussed. A method for the synthesis of gradient polymers and their respective properties as possible coatings polymers are reported. E.D.K.

N81-28168# American Cyanamid Co., Stamford, Conn.
CROSS-LINKING AGENTS FOR WATER-BORNE AND HIGH SOLIDS COATINGS Final Report c27
Werner J. Blank *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 162-166 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Considerable amounts of organic solvents are emitted into the atmosphere during the application of organic coatings. In order to reduce this solvent emission and the resulting pollution, water borne and high solids coatings are being developed. Water borne and high solids polymers have to be cross linked to achieve film properties required for a durable coating system. From the many cross linking mechanisms available to the coating chemist monomeric alkorymethyl melamine cross linkers have shown the broadest utility in high solids and water borne coating systems. The cross liking reaction is a condensation reaction catalyzed by an acid catalyst. Either pH control or alcohol can be used to adjust stability and reactivity in a water borne or high solids coating. E.D.K.

N81-28169# Rohm and Haas Co., Spring House, Pa.
RECENT DEVELOPMENTS IN OXIDATIVE POLYMERIZATION Final Report c27
W. D. Emmons *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 167-172 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The utilization of oxidative polymerization is an attractive route for designing high solids low temperature curing coatings. A key element in this technology is a solvent monomer which is stable under anaerobic conditions but which on exposure to oxygen of the air polymerizes with or cures the other components of the coatings formulation. A suitable monomer for demonstration of this concept is dicyclopentenyloxyethyl methacrylate. The material is based on readily available raw materials and has the necessary viscosity, volatility, polarity, and toxicity balance for use in this application. Three systems are described which illustrate the use of this reactive diluent. These include formulation of high solids architectural alkyd enamels, high build chlorinated rubber marine and maintenance coatings, and finally a high solids oil-free polyester suitable for a variety of industrial primer applications. E.D.K.

N81-28170# Naval Research Lab., Washington, D. C.
FLUORINATED POLYMERS AND THEIR APPLICATIONS Final Report c27
James R. Griffith *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 173-174 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

The fluorinated polymers have intrinsic properties which make them prime candidates for coatings, composites, castings, elastomers, etc., of long service capability. It is essential that life cycle costs be used as a basis of selection since such quality materials would be rarely selected for applications in which only the initial cost were considered. Fluoropolymers were hampered in selection for general purpose use because of the inconvenient means necessary for processing. With the advent of highly fluorinated epoxy, polyurethane, and acrylic polymers this inconvenience is no longer necessary. These materials are highly resistant to degradation by the weather, by biological organisms, by physical abuse, and most conditions encountered by polymeric substances. In additon, they possess a variety of properties such as low friction surfaces, ice release properties, and extremely low fluid absorptions not found in the common substances. E.D.K.

N81-28171# Battelle Memorial Inst., Columbus, Ohio.
RADIATION CURABLE COATINGS Final Report c27
V. D. McGinniss *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 175-180 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

Radiation curable coatings utilize electrical energy for conversion of liquid paint systems into solid finishes but these coatings are 100% convertible so that there are no volatile emissions or pollutin associated with this coating curing process. Radiation curable coatings systems are not energy intensive in that only the energy required for curing is transferred directly to the coating and not lost in unnecessary heating of the substrate. Since heat is not involved in radiation curing of coatings, additional manufacturing processes for substrate heat removal is not required as in conventional thermally cured coatings and this leads to efficient product production. E.D.K.

N81-28172# North Carolina Univ. at Chapel Hill. Dept. of Chemistry.
THE SYNTHESIS OF 1, 1-BICOBALTOCENE SALTS OF TETRACYANO-P-QUINODIMETHANIDE AND THE STRUCTURE OF 1,1 PRIME-BICOBALTOCENE (Co[III]Co[III]) (TCNQ) 3
Chak-po Lau, Phirtu Singh, Susan J. Cline, Reginald Seiders, Maurice Bookhart, Wayne E. Marsh, Derek J. Hodgson, and William E. Hatfield 3 Jun. 1981 37 p refs Submitted for publication
(Contract N00014-76-C-0816; NR Proj. 053-617)
(AD-A100503; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/3

The reaction of 1,1:-bicobaltocene(Co(III)Co(III))(PF6)2 or the analogous mixed valence compound (Co(III)Co(II) with excess ((C2H5)3NH) (TCNQ2 and TCNQ yields the complex salt 1,1:-bicobaltocene(Co(III)Co(III))(TCNQ)3. The complex salt crystallizes in the triclinic system, space group P1 with unit cell dimensions a = 7.475(4), b = 10,113(5), and c = 14.306(3) A, and alpha = = 92.51(3) deg, beta = 98.84(3) deg and gamma = 92.64(4) deg. The conventional and weighted R factors for 1979 reflections for which I was greater than 3o-(I) are R = 0.047 and Rw = 0.044. The TCNQ units stack to form an alternating chain with two short, adjacent interplanar spacings of 3.15 A, followed by a longer interplanar spacing of 3.45 A. The interplanar spacing of the fulvalence moities in the cation is 3.270 A, and the cobalt-carbon bond distances range from 2.012(5) to 2.041(5)A. The complex salt is diamagnetic and the electrical conductivity of a pressed pellet sample is 0.03 ohm/cm. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N81-28173 Cincinnati Univ., Ohio.
ANALYSIS OF THE DYNAMIC AND STATIC BEHAVIOR OF LAMINATED COMPOSITES WITH BONDS Ph.D. Thesis
Elsayed Abdel-Ati Nassar 1981 156 p
Avail: Univ. Microfilms Order No. 8115387

A study is presented of the influence of bonding materials on the dynamic and static behavior of laminated composites. A

specific trilaminated composite model which simulates the case in which one of the materials acts as a bonding agent for the other two materials is considered. In the dynamic case, various methods are employed in order to study the propagation of harmonic elastic waves in trilaminated wave guides. In the static case, the analysis is carried out in order to estimate the influence of bonds on he interfacial shear stresses that develop in laminated composites when subjected to various mechanical and thermal loadings. Dissert. Abstr.

N81-28174 Case Western Reserve Univ., Cleveland, Ohio.
FOURIER TRANSFORM INFRARED SPECTROSCOPIC INVESTIGATION OF THE FIBER-MATRIX INTERFACE IN FIBERGLASS REINFORCED EPOXY COMPOSITES Ph.D. Thesis
Chwan-Hwa Peter Chiang 1981 215 p
Avail: Univ. Microfilms Order No. 8105976

The molecular structures of the coupling agents gamma-aminopropyltriethoxysilane (APS), N-methyl aminopropyltrimethoxysilane (MAPS), and N-2-aminoethyl-3- aminopropyltrimethoxysilane (AAPS) were studied in aqueous solutions and as solids by Fourier transform infrared spectroscopy (FT-IR). The monomeric aminosilane (APS) forms an internal cyclic chelate structure when hydrolyzed in aqueous solution. Heat treatment or ionized chemicals cause the formation of acyclic chain structured aminosilane. In the study of the structure of aminosilane on high surface area silica and E glass fiber, it is found that the aminosilane adsorbed on silica as essentially a monolayer with the amino group hydrogen bonded and oriented toward the glass surface. The amount of silane adsorbed on E glass fiber depends on the concentration of the silane solution. The extent of condensation of silanols of the silane deposited on the glass from toluene solution is higher than that of silanols deposited from aqueous solution. The hydrothermal stability of the coupling agents on the glass surfaces is also examined. It is found that boiling water destroys the integrity of polyaminosiloxane film and removes the coupling agent from the glass surface in a short period of time. Dissert. Abstr.

N81-28175 Oklahoma State Univ., Stillwater.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE PYROLYSIS OF COMPOSITE ABLATIVE MATERIALS Ph.D. Thesis
Jack Bradford Henderson 1980 209 p
Avail: Univ. Microfilms Order No. 8113314

The temperature histories of pyrolyzing composite ablative materials were predicted by a one dimensional thermal model solved by a finite difference numerical technique. These temperatures were compared to experimental data obtained from samples exposed to a known radiant heat flux. Additionally, the specific heat, heat of decomposition, and kinetic properties were determined for the materials of interest and used as input to the thermal model. The kinetic parameters were calculated from experimental data using a multiple heating rate technique. The specific heat of both the virgin and char components, as well as the heat of decomposition was determined by differential scanning calorimetry. Results indicate that the thermal model could accurately predict the thermal response of composite ablatives through pyrolysis. Dissert. Abstr.

N81-28176*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE STRUCTURAL MATERIALS Semiannual Progress Report, 30 Sep. 1980 - 30 Apr. 1981
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberley Jul. 1981 189 p refs Sponsored in part by AF
(Grant NGL-33-018-003)
(NASA-CR-164634; SAR-40) Avail: NTIS HC A09/MF A01 CSCL 11D

The composite aircraft program component (CAPCOMP) is a graduate level project conducted in parallel with a composite structures program. The composite aircraft program glider (CAPGLIDE) is an undergraduate demonstration project which has as its objectives the design, fabrication, and testing of a foot launched ultralight glider using composite structures. The objective of the computer aided design (COMPAD) portion of the composites project is to provide computer tools for the analysis and design of composite structures. The major thrust of COMPAD is in the finite element area with effort directed at implementing finite element analysis capabilities and developing interactive graphics preprocessing and postprocessing capabilities. The criteria for selecting research projects to be conducted under the innovative and supporting research (INSURE) program are described. E.D.K.

N81-28177# Southwest Research Inst., San Antonio, Tex.
INVESTIGATION OF THE EFFECT OF MOISTURE ON THE MECHANICAL PROPERTIES OF ORGANIC MATRIX COMPOSITE MATERIALS USING NUCLEAR MAGNETIC RESONANCE Final Report, 28 Sep. 1979 - 31 Jul. 1980
G. A. Matzkanin May 1981 80 p refs
(Contract DLA900-79-C-1266)
(AD-A100426; SWRI-15-5607-807; AVRADCOM-TR-81-F-5; AMMRC-TR-81-25) Avail: NTIS HC A05/MF A01 CSCL 11/4

Investigations were conducted of nuclear magnetic resonance (NMR) signals from hydrogen atoms in two organic matrix composite systems subjected to environmental conditioning at 51.6C (125F) and 95% relative humidity. The composite systems were 8 ply, + or - 45 deg laminates fabricated from SP 250 resin/S2 glass fiber and Reliabond 9350 resin/Kevlar 49 fiber. Absorbed moisture free induction decays consisted of distinct multiple components attributed to moisture in various states of molecular binding. Plasticizing of the resin matrix resulted in an increase in nuclear relaxation time with increasing moisture. Good correlation was obtained between the NMR signal amplitude and dry weight moisture percentage for both composite systems. Destructive tensile tests were performed on dried specimens and on conditioned specimens at levels of 4.6% and 1.3% dry weight moisture for the Kevlar and glass composites, respectively. Reductions in ultimate tensile strength due to moisture conditioning were 14% for the Kevlar composite and 4.3% for the glass composite. Author (GRA)

N81-28178# Vought Corp., Dallas, Tex. Advanced Technology Center.
THE EFFECT OF ENVIRONMENT ON THE MECHANICAL BEHAVIOR OF AS/3501-6 GRAPHITE/EPOXY MATERIAL, PHASE 3 Final Report, 1 Sep. 1979 - 31 Dec. 1980
T. Ho and R. A. Schapery Washington Dept. of the Navy Jan. 1981 80 p refs
(Contract N00019-79-C-0580)
(AD-A100492; ATC-R-92100/ICR-5) Avail: NTIS HC A05/MF A01 CSCL 11/4

The effect of temperature and moisture on the fatigue properties of AS/3501-6 Gr/Ep composite was investigated. Constant stress amplitude fatigue tests of test specimens and their data analysis were conducted. A probabilistic fatigue failure model derived from the concept of crack propagation has been used as a base for data/analysis correlation. Current data show that the degraded effective modulus of the in-situ matrix should be an important parameter in the analysis of fatigue life prediction. Author (GRA)

N81-28179# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
MODIFICATION OF CARBON-FIBER-REINFORCED COMPOSITES TO MITIGATE FIBER-LOFTING IN BURNING Interim Report
Camille A. Gaulin and Jack L. White 25 May 1981 103 p refs
(Contract F04701-80-C-0081; NR Proj. 039-183)
(AD-A100434; TR-0081(6728-03)-1; SD-TR-81-47) Avail: NTIS HC A06/MF A01 CSCL 11/4

Two lines of investigation have been undertaken to attack the problem of fiber-lofting when carbon-fiber-reinforced composites are subjected to fire or incineration. The objective is to find means to retain the fibers within the matrix char and thus prevent their release before they are destroyed by oxidation. The first investigation employs a chemical approach based on experience with ablation-resistant matrix polymers and seeks to enhance fiber retention by blending high-char-yield polymers into conventional matrix systems. A concurrent microstructural approach includes direct observations of the processes of burning and fiber-lofting and thus seeks to understand the mechanisms by which fibers are released or retained by a composite under fire conditions. The investigations of matrix blending have focused

on hybrid resin systems consisting of polyphenylacetylene (PAC) or polyphenylquinoxaline (PPQ) additions to conventional epoxy novolac resins. Stable and compatible blends have been prepared by selection of suitable solvents. Thermogravimetric analyses show that both char yield in vacuum and the temperature range for oxidation by air are substantially increased by blending. No serious difficulties were encountered in preparing unidirectional composites with the blended resins. GRA

N81-28180# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

CRITICAL PROCESSING CONDITIONS OF A SPECIFIC TERNARY SYSTEM - MOLECULAR COMPOSITE Final Report, Jan. - Sep. 1980

T. Haddeus E. Helminiak, M. Wellman, Wen-Fang Hwang, D. Wiff, Vincent Rodgers, and C. Benner Feb. 1981 78 p refs (AF Proj. 1230; AF Proj. 2303)

(AD-A100205; AFWAL-TR-80-4163) Avail: NTIS HC A05/MF A01 CSCL 11/4

The phase relationship and thus the critical processing conditions, e.g., concentration and temp, (97 MSA/3 CSA), a rigid rod-like polymer (poly-para-phenylenebenzothiazole, PBT), and a flexible chain polymer (poly-2,5(6) benzimidazole, AB-PBI) was studied by means of cross-polarized light microscopy and small-angle light scattering (SALS) technique. Critical concentration points were observed and determined for all four ABPBI/PBT blends studies. When the polymer concentration was higher than the critical concentration, the ternary solution segregated into coexisting anistropic and isotropic phases. The anisotropic phase, containing practically only rigid rod-like PBT polymers, showed distinct nematic features both in the solution and in processed film, while the isotropic phase retained all the ABPBI molecules. Excellent agreement between the experimental and the theoretical binodial curve for the isotropic phase in the phase diagram lend strong support to Flory's recent theory concerning the behavior of mixtures of rigid rod-like polymers with flexible coil polymers. The nematic isotropic transition temperature, IN-I, was also determined for various ABPBI/PBT blends at various concentrations. This study provides the insight of the important parameters such as concentration, temperature, composition, and rod-like polymer orientation of the ternary solution which are necessary for processing of PBPBI/PBT molecular composite films. Author (GRA)

N81-28181# Atomic Energy Research Establishment, Harwell (England). Non-Destructive Testing Centre.

NONDESTRUCTIVE EXAMINATION OF COMPOSITE MATERIAL: A SURVEY OF EUROPEAN LITERATURE Final Report, Oct. 1979 - Feb. 1980

William N. Reynolds May 1981 89 p refs

(Contract DAJA37-79-C-0553)

(AD-A100454; USAAVRADCOM-TR-81-F-6; AMMRC-TR-81-24) Avail: NTIS HC A05/MF A01 CSCL 11/4

The references corresponding to the nondestructive examination of fiber-reinforced composite materials have been retrieved from the Harwell NDT Centre information system and all those relating to European work have been examined. This has produced a comprehensive list of techniques used and of institutions and companies which have so far played an active part in the field. Apart from the relatively few industries which have met the need to develop testing procedures for composite materials in production or use, a much larger number of universities and research organizations have carried out fundamental studies of the problems involved which enable some conclusions to be drawn about the outstanding difficulties. These include some useful reviews of the subject. In addition, samples of composite materials have been included in some general testing programs, and references to a number of these are included. Author (GRA)

N81-28182# Georgia Inst. of Tech., Atlanta. School of Textile Engineering.

PRECURSOR STRUCTURE-FIBER PROPERTY RELATIONSHIPS IN POLYACRYLONITRILE BASE CARBON FIBERS Interim Report, 1 Jun. 1979 - 31 May 1980

Wayne C. Tincher, Fred L. Cook, and A. S. Abhiraman 26 May 1981 35 p refs

(Contract N00014-79-C-0523)

(AD-A100453; E27-679-1) Avail: NTIS HC A03/MF A01 CSCL 11/5

A complete facility has been designed and constructed to prepare carbon fiber under carefully controlled conditions from selected monomer and polymers. The facility includes laboratory polymerization equipment for preparing and characterizing acrylonitrile copolymers; a spinning dope preparation unit for preparing polymer solutions for extrusion; fiber wet-spinning equipment for conversion of polymer to fiber form; two linear ovens for programmed heat treatment of fiber to produce a stabilized yarn; and two high temperature furnaces for conversion of stabilized fiber to carbon fiber. All processing steps can be carried out under carefully controlled conditions of time, temperature and tension. All units of the facility have been tested and several minor problems have been identified and corrected. All components are now fully operational. GRA

N81-28183# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

STABILIZATION OF ACRYLIC FIBERS AND MICROSTRUCTURE OF CARBON-CARBON COMPOSITES Final Report

D. R. Uhlmann 7 Jun. 1981 33 p refs

(Grant AF-AFOSR-3466-77; AF Proj. 2303)

(AD-A101124; AFOSR-81-0526TR) Avail: NTIS HC A03/MF A01 CSCL 11/9

The work on the stabilization of acrylic fibers has demonstrated that various mantle-core structures are observed at intermediate stages of stabilization, that the dark mantles seen in optical thin sections can be related to the etched mantles seen on exposure to solvents for PAN, that the mantles seen on fractured fiber ends reflect the underlying structure of the partly-stabilized fibers, that the development of these various mantless with time depends on the nature of the precursor fibers and the processing conditions, that liquid droplets can be produced during fracture of fibers during stabilization, and that the fracture of even a small number of fibers can produce effective cementation of a yarn during processing. The study of the interaction between mesophase material and carbon fibers has directed attention to the precipitation, growth and coalescence of mesophase material, which processes require ordering of small molecules in a viscous medium. On this basis, dynamic motion in the fluid rather than the presence of nucleating substrates is suggested to be the controlling factor in the structural development. Where dynamic motion is restricted, as in the interstices of a yarn, mesophase formation and growth are also restricted. Alignment of mesophase material with a substrate is primarily controlled through motion of the mesophase droplets in flow, which generally do not wet the substrate. Certain well-order surfaces are wetted by the mesophase material, but the effect is primarily noted on surfaces of comparable size to the droplets. Author (GRA)

N81-28184# Carnegie-Mellon Univ., Pittsburgh, Pa.

STRUCTURAL AND KINETIC PROPERTIES OF GRAPHITE INTERCALATION COMPOUNDS Annual Report, 1 Mar. 1980 - 28 Feb. 1981

D. D. L. Chung 18 Jun. 1981 66 p refs

(Grant AF-AFOSR-3536-78; AF Proj. 2306)

(AD-A101040; AFOSR-81-0532TR) Avail: NTIS HC A04/MF A01 CSCL 07/4

The processes of the intercalation of graphite, the desorption of intercalated graphite, and the exfoliation of intercalated graphite have been studied by using X-ray diffraction, X-ray absorption, optical microscopy, thermogravimetry, dilatometry and acoustic emission measurement. Emphasis was given to the structural changes which occur during these processes and the kinetics of these processes. For bromine intercalation, it was found that intercalation does not involve a progressive change in stage, although the final stage (n) may be dominated by the next higher stage (n-1) during the early part of the intercalation process. Furthermore, it was confirmed that the final stage increases with increasing temperature for the same intercalate activity, and that the rate of interaction increases with increasing temperature. On the other hand, desorption was found to involve a progressive increase of stage. Moreover, desorption was found to begin at the edge of the sample, resulting in a difference in stage between the edge and central regions of the c-face; the concentration gradient was found to increase with decreasing stage. The amount of expansion observed on exfoliation was found to be determined

principally by the parent stage formed during intercalation; the higher is the stage of the parent, the larger is the amount of expansion. GRA

N81-28185# Tennessee Technological Univ., Cookeville. Dept. of Chemical Engineering.
REDUCTION IN THE THERMAL RESISTANCE (R-VALUE) OF LOOSE-FILL INSULATION AND FIBERGLASS BATTS DUE TO COMPRESSION
D. W. Yarbrough and J. H. Wright Apr. 1981 84 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7715/2) Avail: NTIS HC A05/MF A01

A method is presented for calculating the thickness reduction of loose fill insulations and fiberglass batts that result from compressive forces exerted by additional insulation. The thickness reduction is accompanied by an increase in density and a reduction in the R value of the compressed layer. Calculations for thermal resistance of two layers of insulation are given. DOE

N81-28186# Washington Univ., St. Louis, Mo. Materials Research Lab.
ENVIRONMENTAL EFFECTS ON MECHANICAL PROPERTIES OF A KEVLAR 49/EPOXY COMPOSITE
H. T. Hahn and W. K. Chin 1980 64 p refs
(Contract W-7405-eng-48)
(UCRL-15330) Avail: NTIS HC A04/MF A01

The composite was filament-wound using an epoxy formulated at Lawrence Livermore National Laboratory (LLNL). The temperature and vacuum chosen were 750 C and approximately 0.007 torr, respectively. Specimens were preconditioned in the test environment for periods of 1 to 5 months before mechanical tests. The simulated service environment of 750 C in vacuum was found to have little effect on static and fatigue properties. While the elevated temperature of 750 C was not deleterious, the lack of air could be beneficial because it eliminates the possibility of oxidation. DOE

N81-28187# California Univ., Livermore. Lawrence Livermore Lab.
FIBER COMPOSITE MATERIAL CHARACTERIZATION: APPLICATIONS OF AN OPTIMIZATION ALGORITHM
J. C. Trinkle 16 Jan. 1981 37 p
(Contract W-7405-eng-48)
(UCID-18998) Avail: NTIS HC A03/MF A01

A nonlinear programming algorithm which has proven to be very useful in analyzing fiber composite testing data is described and flow charted. Applications include fatigue life and stress rupture life analyses, S-N curve fitting, stress-strain curve fitting, statistical strength characterization, and other modeling parameter estimation. The appendix contains an example concerning stress rupture life, the listing of a code which implements the nonlinear programming algorithms, and the input and output from the run. DOE

N81-28188# Sandia Labs., Albuquerque, N. Mex.
CHEMICAL VAPOR DEPOSITION OF BORON AT LOW TEMPERATURES
H. O. Pierson and A. W. Mullendore 1981 11 p refs Presented at the Intern. Conf. on Met. Coatings, San Francisco, 6 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0475C; CONF-810425-4) Avail: NTIS HC A02/MF A01

The formation of boron coatings obtained from the dissociation of diborane as a function of temperature, pressure and the effect of plasma activities was investigated. At one atm. pressure, pure boron was formed only at deposition temperatures above 500 C; below that temperature partial dissociation occurred and the deposited boron was combined with boron polymers. To remove these polymers (as they were formed), it was necessary to operate at low pressure approximately 50 m Torr); this allowed boron coatings to be deposited at temperatures as low as 350 C. By activating the diborane in a RF field, it was possible to deposit boron as low as 150 C. In all cases, the deposited boron was very dense, uniform and amorphous. DOE

N81-28189# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Technological Centre.
THIRTY YEARS EXPERIENCE WITH PRIMARY ADHESIVE BONDED STRUCTURES
Rob J. Schliekelmann 1980 32 p
(FOK-BO-1240) Avail: NTIS HC A03/MF A01

The historical development of techniques used in the fabrication and quality control of adhesive bonded structures for to the F-27 and F-28 aircraft is reviewed. The evolution of the use of metal bonding from reinforcement of riveted joints to primary structures is illustrated. Thin sheet bonded laminates are shown to have better fracture toughness leading to lower crack propagation speed and higher residual strength in the cracked state. The hot air high pressure autoclave, using an aluminum blanket/aluminum pebbles for pressure distribution during curing, is depicted. Quality control is performed separately for adhesion and cohesion. Electron microscopy is used to verify the condition of anodized surfaces. The in-house development of sonic and holographic bond testers is mentioned. Flying hours and related service life data for the world wide fleet of F-27 and F-28 aircraft are given. Author (ESA)

N81-28190# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Technological Centre.
NONDESTRUCTIVE TESTING OF ADHESIVE BONDED JOINTS
Rob J. Schliekelmann Apr. 1980 38 p refs
(FOK-BO-1241) Avail: NTIS HC A03/MF A01

Nondestructive test methods currently used in the aircraft industry are surveyed. Advantages and disadvantages are cited and preferred methods are identified for given airframe manufacturers. Comparative evaluation results for methods used for metal to metal and for honeycomb sandwich structures bonded with a modified epoxy adhesive film are shown. Adherend surface inspection methods are included. Cohesion testing, using capacitance measurement and thermal inspection methods are covered. Acoustic emission, radiography, acoustic inspection, sonic testing, ultrasonic techniques and holographic interference methods are considered. Nondestructive acceptance testing is discussed in terms of the joint geometry problem. Equipment and test recordings are shown. Author (ESA)

N81-28155# Union Carbide Corp., Parma, Ohio.
CARBON FIBERS Final Report
Roger Bacon *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 54-57 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28161*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CARBON-FIBER TECHNOLOGY Final Report
C. Frederick Hansen and John A. Parker *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 125-130 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11D

N81-28162*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED RESIN SYSTEMS FOR GRAPHITE EPOXY COMPOSITES Final Report
W. J. Gilwee and A. Jayarajan *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 131-135 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11D

N81-28163# Rockwell International Science Center, Thousand Oaks, Calif.
ADVANCED COMPOSITES FOR AUTOMOTIVE APPLICATION Final Report
C. I. Hamermesh *In* American Chemical Society The 16th Natl Symp. on Polymers in the Serv. of Man 1980 p 137-140 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 11/4

N81-28164# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPATIAL DISTRIBUTION OF VOLATILE COMPOUNDS IN GRAPHITE COMPOSITES Final Report

Michael A. Grayson (McDonnell Douglas Research Labs.), Clarence J. Wolf (McDonnell Douglas Research Labs.), and Demetrius A. Kourtides *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 141-147 refs (For primary document see N81-28146 19-23)
(NASA Order A-67827-B)
Avail: NTIS HC A09/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-28191 Arizona State Univ., Tempe.
ULTRATRACE ORGANIC ANALYSIS OF DICHOTOMOUS FILTERS USING GC AND GC/MS TECHNIQUES Ph.D. Thesis
William Dale Bowers 1981 150 p
Avail: Univ. Microfilms Order No. 8113798

Investigations were conducted in the developmet of an analytical procedure suitable for the analysis of organic components associated with the respirable fraction of airborne particulate matter collected by dichotomous samplers. The dichotomous samples possess an estimated total organic concentration of 2 ng, which requires a highly efficient extraction technique in order to detect the organic constituents which are present at the ultratrace levels. Soxhlet and ultrasonic extraction efficiencies were studied by spiking Teflon filter elements with standard mixtures containing n hydrocarbons 1 alcohols, phthalate esters, and polaromatic hydrocarbons. Following extraction with methylene chloride, the extracts are condensed and analyzed by gas chromatography flame ionization detection. Preliminary evaluation of thermal desorption technique was also conducted. Dissert. Abstr.

N81-28192 Florida State Univ., Tallahassee.
ANALYTICAL DATA PROCESSING METHODS FOR FOURIER TRANSFORM SPECTROSCOPIES Ph.D. Thesis
Charles Lucian Dumoulin 1981 164 p
Avail: Univ. Microfilms Order No. 8113259

Spectral data sets are stored in 32-bit floating point format and can consist of up to 16,384 complex points. The limitation of 16-bit CPU architecture necessitated the implementation of virtual data arrays to accommodate large data sets. Two virtual array manipulation techniques were developed: transparent and explicit. The transparent mechanism is easier to use but is at least an order of magnitude slower than the explicit mechanism. Comparisons of the mechanisms for a Fast Fourier Transform algorithm indicate that the transparent mechanism is inadequate for large data sets. Quantitative C-13 NMR techniques were developed and verified. Improvements in precision were obtained by the use of sophisticated integration software. Algorithms were developed to characterize and correct baseline distortions, define integration limits, and correct for experimental effects. A factor of three increase in integral precision over standard methods is demonstrated. Dissert. Abstr.

N81-28193 Washington Univ., Seattle.
MULTICOMPONENT MIXTURE DATA ANALYSIS: APPLICATIONS OF THREE DIMENSIONAL TECHNIQUES Ph.D. Thesis
Carl J. Appellof 1981 90 p
Avail: Univ. Microfilms Order No. 8113429

The use of mathematical techniques for analyzing three dimensional data arrays is discussed. These arrays can be obtained as the result of many different instrumental analysis methods. Both qualitative and quantitative analysis of mixtures can be performed. It is shown that the use of more than one dimension of data can significantly improve both kinds of analysis. A mathematical method for qualitative analysis of a multicomponent fuorescent mixture is developed. This method analyzes a three dimensional matrix obtained by passing the effluent of a high pressure liquid chromatogram (HPLC) through the video fluorometer, and provides an estimate of the number of components in the mixture as well as the emission and excitation spectra and HPLC profile for each component. The method of rank annihilation for quantitative analysis of a multicomponent mixture is extended to a three dimensional data array. Improved accuracy over the two dimensional method is shown. An example using data from a video fluorometer detected liquid chromatograph is presented. Dissert. Abstr.

N81-28194 California Univ., Berkeley.
THE APPLICATION OF HIGH RESOLUTION ELECTRON ENERGY LOSS SPECTROSCOPY TO THE CHARACTERIZATION OF SMALL MOLECULES ABSORBED ON RHODIUM SURFACES Ph.D. Thesis
Lawrence Henry Dubois 1980 251 p
Avail: Univ. Microfilms Order No. 8113018

High resolution electron energy loss spectroscopy (ELS), thermal desorption mass spectrometry (TDS), low energy electron diffraction (LEED) and Auger electron spectroscopy (AES) are used to study: (1) the chemisorption of CO, CO2, and O2 on the Rh-111 single crystal surface; (2) the bonding and chemical transformations of C2H2 and C2H4 on Rh-111; (3) the chemisorption and subsequent reactions of NO, O2 and CO on Rh-331; and (4) the chemisorption of CO on model alumina supported rhodium catalysts. The vibrational spectra of carbon monoxide on Rh-111 indicate two distinct binding sites whose relative populations and vibrational frequencies are determined by both the substrate temperature and the background pressure. The TDS measurements show the the bridge bonded CO to have an approximately 4 kcal/mole lower binding energy to the surface than the species located in the atop site. The adsorption of carbon dioxide yields virtually identical TDS and ELS spectra to that of chemisorbed CO, indicating dissociative adsorption. Dissert. Abstr.

N81-28195 California Univ., Berkeley.
WAVE MIXING SPECTROSCOPY Ph.D. Thesis
Robert William Smith 1980 180 p
Avail: Univ. Microfilms Order No. 8113193

Several aspects of nonlinear or wave mixing spectroscopy were investigated utilizing the polarization properties of the nonlinear output field and the dependence of this field upon the occurrence of multiple resonances in the nonlinear susceptibility. It is shown theoretically that polarization sensitive detection may be used to either eliminate or controllably reduce the nonresonant background in coherent anti-Stokes-Raman spectroscopy (CARS), allowing weaker Raman resonances to be studied. These four wave mixing techniques are called background suppression-CARS and optical heterodyned detection CARS. These are experimentally demonstrated by studying the 992 cm Raman mode of benzene diluted in carbon tetrachloride with an attained detection sensitivity of 100 ppm of benzene. This corresponds to a ratio of resonant to nonresonant susceptibilities of about 4x10 to the minus 3rd power. Experimental techniques, possible applications, and limitations of these techniques are discussed. Dissert. Abstr.

N81-28196 State Univ. of New York at Buffalo.
NOVEL ELECTROCHEMICAL METHODS FOR TRACE LEVEL DETERMINATIONS OF AQUEOUS ANALYTES Ph.D. Thesis
Paul Robert Gifford 1980 121 p
Avail: Univ. Microfilms Order No. 8114678

Several electrochemical techniques for the determination of aqueous analytes were developed and applied to a range of analytical problems. These techniques are of two general types: (1) using rotating ring disk electrodes, and (2) using gold gas-porous electrodes. The use of the ring shielding mode of the rotating ring disk electrode for submicromolar determinations of Ag(I), Bi(III), Cu(II), and Fe(III) is described. A method for trace level determinations is presented in which the solute of interest is reacted to form a volatile electroactive product which is flushed from solution using an electroinactive gas. The gas stream passes over one surface of a hydrophobic gas porous electrode where the electroactive species is electrolyzed at constant potential giving a current response proportional to the initial amount of solute. The use of a porous electrode structure to determine the concentration of an electroactive species present

in the gas phase is denoted as pneumatoamperometry in the case of potentiostatic control and current measurement.
Dissert. Abstr.

N81-28197 Purdue Univ., Lafayette, Ind.
THE DEVELOPMENT OF AN ANGLE-RESOLVED MASS SPECTROMETER AND ITS APPLICATION TO ION CHEMISTRY AND REACTION DYNAMICS Ph.D. Thesis
James Andre Laramee 1980 316 p
Avail: Univ. Microfilms Order No. 8113782

Ion/molecule and ion/atom reactions occurring at kiloelectron volt energies and the unimolecular dissociation of metastable ions were investigated. The investigation of these reactions was accomplished through measurements of ion translational energy. For the bimolecular reactions, angle resolved mass spectrometry was utilized. Dissert. Abstr.

N81-28198 Purdue Univ., Lafayette, Ind.
MASS SPECTROMETRY/MASS SPECTROMETRY: APPLICATIONS AND NEW INSTRUMENTATION Ph.D. Thesis
Gary Lee Glish 1980 198 p
Avail: Univ. Microfilms Order No. 8113686

A mass spectrometry/mass spectrometry instrument is a hybrid instrument consisting of a magnet and two quadrupoles, and is termed a BQQ mass spectrometer. This indicates one of the modes of operation, although several others are discussed. These other modes are possible because of the modular form in which the instrument was built. This instrument has already shown great potential for the study of the collision induced dissociation (CID) phenomenon. It was found that variation of the ion kinetic energy, in the ten to hundreds of electron volts, varies the amount of internal energy deposited in the ion and therefore the amount of fragmentation. The use of ion kinetic energy was shown to have potential applications for determination of appearance potentials of ion/molecule association products formed in ms/ms reactions. The use of ms/ms in conjunction with ion/molecule association reactions for differentiation of structural isomers was also demonstrated. As another application of ms/ms to ion/molecule reactions, several reactions occurring in the chemical ionization source was characterized. Dissert. Abstr.

N81-28199 Tennessee Univ., Knoxville.
ANALYTICAL APPLICATIONS OF FOURIER TRANSFORM INFRARED SPECTROSCOPY. PART 1: MATRIX-ISOLATION SPECTROSCOPY. PART 2: TIME-RESOLVED SPECTROSCOPY Ph.D. Thesis
Arlene Allen Garrison 1981 156 p
Avail: Univ. Microfilms Order No. 8115257

Two chemical applications of Fourier transform infrared spectroscopy were evaluated. Spectra of matrix isolated samples of nitrogen and oxygen containing aromatic compounds are presented and interpreted. Results of studies of time resolved photochemical phenomena are presented. Matrix isolated Fourier transform infrared spectroscopy was shown to be a suitable technique for the analysis of three classes of nitrogen containing aromatic compounds: the neutral aza-arenes with a pyrrole type nitrogen, the basic aza-arenes with a pyridine type nitrogen, and the basic aromatic amines with an aniline type nitrogen. The use of this sampling technique in the analysis of hydroxylated aromatic compounds was also demonstrated. A gas chromatographic interface was used in the analysis of nitrogen and oxygen containing constituents in a standard shale oil. Results are generally within 10 percent of the previously established values and indicate the ability to quantitatively analyze an environmental sample at the 300 ng level. Dissert. Abstr.

N81-28200 Tennessee Univ., Knoxville.
DYE LASER EXCITED FLUORESCENCE SPECTROSCOPY OF MATRIX ISOLATED POLYCYCLIC AROMATIC HYDROCARBONS Ph.D. Thesis
Randall Robert Gore 1981 170 p
Avail: Univ. Microfilms Order No. 8115258

Although steady state matrix isolation fluorometry was shown to be a viable method of analysis for polycyclic aromatic hydrocarbons (PAHs), inadequate resolution of spectral components remains the primary limitation of the technique. In most cases, the broad emission bandwidths are due to occupation by solute molecules of a large variety of different sites within the matrix. By using the high degree of monochromaticity characteristic of laser light, subsets of this distribution of sites can be selectively excited resulting in a high degree of spectral resolution. The importance of inhomogeneous broadening in matrix isolation spectra of PAHs was confirmed by the achievement of site selection. Emission bandwidths as low as 13/cm were obtained. Site selection fluorometry of matrix isolated PAHs was shown to exhibit analytical calibration curves which are linear over at least two orders of magnitude. Expressed in terms of relative standard deviation, the precision of matrix isolation site selection fluorometric analysis was on the order of 8 percent.
Dissert. Abstr.

N81-28201 Tennessee Univ., Knoxville.
HIGH TEMPERATURE COMBUSTION OF PULVERIZED COAL Ph.D. Thesis
William Lee Holt 1981 182 p
Avail: Univ. Microfilms Order No. 8115263

Studies were made on the effects of mixing rate and residence time on the combustion of bituminous coal Nominal heating rates of 100,000 degrees K per second with final combustion temperatures on the other of 3000 K characterized the typical test conditions. The stoichiometry was nominally 0.90 with oxygen concentrations in the oxidant above 55 percent. The experimental results were compared to a theoretical coal combustion model involving a one step, first order Arrhenius reaction rate constant. This model proved to be adequate for the test conditions being studied. Conclusions were reached as to the behavior of pulverized coal under flame conditions such as those that might be experienced in an MHD coal combustor. Qualitative information is presented as to the behavior of the coal particles during combustion and subsequent burn-out of the carbon.
Dissert. Abstr.

N81-28202 South Carolina Univ., Columbia.
THE DETERMINATION OF THE POTENTIAL FUNCTIONS FOR SOME MOLECULES WITH LOW FREQUENCY ANHARMONIC VIBRATIONS Ph.D. Thesis
Jeffrey Scott Church 1980 318 p
Avail: Univ. Microfilms Order No. 8114330

The microwave spectrum of ethyldifluorophosphine was recorded. A-type transitions were observed and R-branch assignments were made for the ground vibrational state as well as four excited vibrational states of the transconformer. The infrared and Raman spectra were recorded for both the gaseous and solid phases of ethyldifluorophosphine d0 and d5. Additionally, the Raman spectra of the liquids were recorded. All of the normal modes of the transconformer except the CH3 torsion were assigned and a normal coordinate calculation was carried out. Evidence of the gauche conformer was found in the fluid phases. A value for beta H was obtained and the symmetric potential function was calculated. The barriers to methyl rotation for the gauche conformer were determined. Dissert. Abstr.

N81-28203 South Carolina Univ., Columbia.
A FUNDAMENTAL STUDY OF THE MICROWAVE-EXCITED PLASMA Ph.D. Thesis
Dennis Thomas Pipes 1980 103 p
Avail: Univ. Microfilms Order No. 8114345

An investigation is presented which details systematic and random errors encountered when electrical probe measurements are made on the microwave excited plasma. The accuracy and precision of the probe measurements are discussed, and the use of probes as a diagnosis tool is evaluated. A study on the atom formation process in the microwave plasma is presented. The ability of the plasma to break apart molecular species into their constituent atoms is examined as a function of a number of experimental factors. A correlation between a term called the atomization ratio and the electrical probe measurement yields interesting insight into the atom forming mechanism. The physical characteistics of the plasma are found to be dramatically affected by the use of a transient magnetic field. During the time frame of the pinch effect, the plasma is physically condensed. The spectral emission is found to increase and the ability to atomize molecular species is enhanced. Dissert. Abstr.

N81-28204 Illinois Univ. at Urbana-Champaign.
QUANTITATIVE PHOTOACOUSTIC REACTION-RATE

MEASUREMENTS UNDER MICROCOMPUTER CONTROL Ph.D. Thesis
Phillip Ralph Bross 1981 163 p
Avail: Univ. Microfilms Order No. 8114392

Quantitative photoacoustic reaction rate measurements under microcomputer control are demonstrated by the reaction of lysine and leucine with ninhydrin in a starch matrix. Coground amino acid/starch standards are analyzed in 200 seconds using initial reaction rate conditions with a percent relative standard deviation generally better than 20% for 0.1 - 3.7 wt% standards. A single analysis requires approximately 10 mg of sample and 40 microliters of ninhydrin reagent. The implications of this photoacoustic application are the potential analysis of proteins in gram samples as well as other quantitative surface measurements. Nonkinetic quantitative data for the 2,2 prime bipyridyl-ruthenium(II) ion exchanged into a 13X zeolite are also presented. A calibration curve for the ruthenium chromophore was prepared by cogrinding tris -2,2 prime - I bipyidly ruthenium(II) dichloride hexahydrate with various amounts of 600 mesh 13X zeolite. Percent relative standard deviations from 1-8% for 0.2-2.7 wt% ruthenium salt concentrations were obtained.
Dissert. Abstr.

N81-28205 Kansas Univ., Lawrence.
APPLICATION OF THE TRANSCORRELATED METHOD TO THE SOLUTION OF THE ELECTRONIC SCHROEDINGER EQUATION Ph.D. Thesis
Arthur Warren Williamson 1980 784 p
Avail: Univ. Microfilms Order No. 8111762

The ability of the transcorrelated method to produce highly accurate solutions of the electronic Schrodinger equation is discussed. Computationally convenient equations, which facilitate the application of this method to a general, N-electron, closed-shell system, are derived in considerable detail. Results of transcorrelated calculations on three 2-electron systems, the helium atom, the hydrogen molecule, and the H3(+) ion, are shown. The most accurate transcorrelated energies represented the recovery of 90 per cent of the electron correlation energy for the Helium atom and the Hydrogen molecule. The equilibrium bond length of the Hydrogen molecule was predicted with an error of only 0.0015 bohr. The transcorrelated method behaves very much like a variationally correct method, especially with the larger ontraction basis sets. All of the transcorrelated energies remained above the accepted non-relativistic energy. Where appropriate comparisons are possible, the transcorrelated wavefunctions are shown to be converging towards the variationally correct wavefunctions as the orbital and correlation basis sets are increased in size.
Dissert. Abstr.

N81-28206 Iowa Univ., Iowa City.
DESIGN AND CONSTRUCTION OF A MICROCOMPUTER-CONTROLLED SQUARE-WAVE POLAROGRAPH Ph.D. Thesis
William John Sheleski 1980 255 p
Avail: Univ. Microfilms Order No. 8114301

The circuitry and design of a square-wave polarograph controlled by a dedicated microcomputer is described. The operational parameters of the instrument are controlled by a combination of both software and interface hardware. The device was designed to take full advantage of the advances in electronic component over the past few years. Solid state integrated circuitry is used exclusively in the instrument, which improves the reliability of the device and greatly simplifies maintenance of it. The microcomputer used in conjunction with the instrument performs three basic functions: control of the instrument as it obtains the polarogram of the solution of interest; conversion of the analog data collected during the experiment to machine-readable digital numbers stored in the computer memory; and outputting this data in a format that can be accepted by a more powerful master computer for data processing purposes. The microcomputer allows most of the functions of the instrument to be controlled by software so that changes in these functions can be implemented by merely changing the operating program.
Dissert. Abstr.

N81-28207# Air Force Academy, Colo. Energetic Materials Div.
A LIQUID CHROMATOGRAPHY DETECTOR FOR TRANSITION AND RARE-EARTH METAL IONS BASED ON A CUPRIC ION-SELECTIVE ELECTRODE
R. Cameron Dorey May 1981 221 p refs
(AF Proj. 2303)
(AD-A100455; FJSRL-TR-81-0005) Avail: NTIS HC A10/MF A01 CSCL 07/2

A potentiometric detector sensitive to many transition and rare earth metal ions has been developed, using a cupric ion-selective electrode. The sample stream is mixed with a stream of copper(II)-ethylene-diaminetetraacetic acid complex (CuEDTA), and metal ions in the eluent displace copper(II) from the complex. The increase in free copper(II) is then measured by the electrode. Background copper(II) level in the CuEDTA stream sets the lower limit of detection of metal ions at approximately 3X10-7th power M, and the detector response characteristics require that approximately 500micro l. flow through the detector to reach steady-state response. This establishes a detection limit of 1.5X10-10th power mole metal ion. Theoretical response of the detector has been developed and the experimental values agree closely with theory for specific metals over the range 3X10-7th power M to 1/100 M metal ion. Both transient and steady-state response of the detector to metal ions and some common anions, including halide ions, is shown, and the advantages and limitations of the system are discussed. GRA

N81-28208# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
THEORETICAL EQUATION OF STATE FOR SIMPLE LIQUIDS AT HIGH PRESSURES Final Report, Sep. 1978 - Aug. 1980
Hermenzo D. Jones 26 Mar. 1981 20 p refs
(AD-A100396) Avail: NTIS HC A02/MF A01 CSCL 07/4

A perturbation technique which is particularly well suited for high pressures is used to calculate thermodynamic properties for a simple liquid whose molecules interact via a Buckingham (exp-6) potential. There is good agreement between computations and experiments for moderate temperature isotherms for liquid nitrogen. A calculation of the shock Hugoniot of liquid nitrogen exhibits excellent agreement with experimental data.
Author (GRA)

N81-28209# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE INFLUENCE OF PHYSICAL PROPERTIES ON BLACK POWDER COMBUSTION
Ronald A. Sasse Mar. 1981 65 p refs
(Contract DA Proj. 1L1-61102-AH-43)
(AD-A100273; AD-E430625) Avail: NTIS HC A04/MF A01 CSCL 19/1

It has been observed that black powder made from ingredients of the same lot and fabricated using the same manufacturing procedure results in material exhibiting different burning rates. The current study was undertaken to determine if the physical properties of black powder affected burning rate and established if these properties varied from one production batch to another. Physical properties of black powder were measured including surface area, pore size distribution, and internal free volume. Black powder derived from oak and maple charcoals was compared, and the effects of processing the material by a jet mill or ball mill were contrasted. Scanning electron microscopy revealed that applied pressure, a manufacturing step used in making black powder, induced considerable plastic flow that resulted in a fused conglomerate, cohesive mass containing interconnecting passageways of about 0.1 micron diameter. Density, free volume, and surface area were found to be functions of burning rate. Based on these relationships, the conclusion was offered that the degree of openness of a grain of black powder is a significant factor affecting its burning rate. GRA

N81-28210# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL STUDIES OF IGNITION PHENOMENA IN ONE-DIMENSIONAL PROPELLING CHARGES Technical Report, Oct. 1978 - Sep. 1979
Thomas C. Minor and Albert W. Horst Apr. 1981 58 p refs
(Contract DA Proj. 1L1-62618-AH-80)
(AD-A100298; AD-E430627) Avail: NTIS HC A04/MF A01 CSCL 21/2

During the past decade, several unsteady, two-phase flow

interior ballistic models have been developed which include treatment of ignition and flamespread through the propellant bed. While all such models were originally formulated under the simplifying assumption of one dimensional flow, efforts are now underway to provide multi-dimensional representations, as well as to improve the descriptions of constitutive physical process. One important step, however, along the road to a phenomenologically complete model should be a critical assessment of available one dimensional codes by means of comparison to 'one dimensional' experiments. To that end, we describe herein a series of four, well-instrumented, 'one dimensional' test firings conducted in the Navy 5-inch fiberglass breech gun. Two rounds were fired using Navy NOSOL 318 propellant, a solventless-processed gun propellant offering excellent control over grain dimensions and physical and chemical homogeneity. The other two rounds were fi : with M30A1 triple-based gun propellant, employed in the Army 155-mm, M203, Propelling Charge. Data recorded during these tests included flame propagation, breech and sidewall gas pressure profiles, and sidewall case strains. Comparisons of experimental results with simple theoretical simulations of these events using the NOVA two-phase flow interior ballistics code are presented both to suggest possible areas of future concern to model developer and to assess the adequacy of current experimental techniques. GRA

N81-28211# Chicago Univ., Ill. Dept. of Chemistry.
THERMAL DESORPTION OF Xe FROM THE W(110) PLANE
R. Opila and R. Gomer Jun. 1981 49 p refs
(Contract N00014-77-C-0018)
(AD-A100343; Rept-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

Thermal Desorption of Xe from the (110) plane of tungsten can be followed layer by layer for 3 monolayers. In each case desorption is zero order until coverage is 0.3, when a sharp switch to first order occurs. The presence of even small amounts of oxygen kills the zero order regime in the first layer. Possible explanations for this behavior are given. The activation energies of desorption are shown to less than the corresponding enthalpies in each case, and the meaning of this result is discussed. Author (GRA)

N81-28212# Illinois Univ. at Chicago Circle, Chicago.
HIGH ENERGY MATERIALS. NEW PREPARATION APPROACHES TO NITRO AND NITROSO DERIVATIVES Annual Report, 1 Apr. 1980 - 31 Mar. 1981
Joseph H. Boyer and T. Perumal Pillai 1 Jun. 1981 57 p refs
(Contract N00014-79-C-0353)
(AD-A100142) Avail: NTIS HC A04/MF A01 CSCL 07/2

Hydrazine and hydroxylamine efficiently transformed dicyanofuroxan into pyridazino- and oxazinofuroxans. Product identification has clarified the reaction between iodoacetonitrile and silver nitrate. A series of azepne oxides was obtained from peroxidation of aldimine derivatives of diaminomaleonitrile. Nitrobenzofuroxans were peroxidized into polynitrobenzene compounds; benzodifuroxan was peroxidized into 1,2,3,4-tetranitrobenzene. Investigations on 2-nitroso-3-nitrosuccinonitrile, 2,3-dinitrosuccinonitrile and related compounds are underway. Author (GRA)

N81-28213# Indiana Univ. at Bloomington. Dept. of Chemistry.
SIMPLE AND INEXPENSIVE DESIGN FOR AN ISOLATED DROPLET GENERATOR USEFUL IN STUDIES OF ATOMIZATION IN FLAMES Interim Technical Report
R. E. Russo, R. Withnell, and G. M. Hieftje 17 Jun. 1981 25 p
(Contract N00014-76-C-0838)
(AD-A100463; TR-37; TR-45) Avail: NTIS HC A02/MF A01 CSCL 14/2

A new design is presented for a droplet generator useful in studies of atomization processes in analytical flames. Based in part on medium-scale integrated circuitry, the design is superior in performance to earlier models and is far simpler to construct. Fabrication details are provided and the performance of the new device is assessed. Author (GRA)

N81-28214# Washington Univ., Seattle. Lab. for Chemiometrics.
ANALYTICAL CHEMISTRY AS AN INFORMATION SCIENCE Interim Report, Feb. - Jun. 1981
Bruce R. Kowalski Jun. 1981 14 p refs Submitted for publication
(Contract N00014-75-C-0536; NR Proj. 051-565)
(AD-A100433; Rept-20) Avail: NTIS HC A02/MF A01 CSCL 07/2

This paper resulted from a presentation with the same title at the Symposium on New Directions in Analytical Chemistry held at the Pittsburg Conference in Analytical Chemistry and Spectroscopy, Atlanta City, March, 1981. This paper attempts a look into the future of Analytical Chemistry discussing such possibilities as intelligent analytical instrumentation and the generation and analysis of chemical pictures. Author (GRA)

N81-28215# Kansas State Univ., Manhattan.
DIFFUSION FLAME STUDIES OF THE CHEMICAL AND PHYSICAL MECHANISMS OF SOOT FORMATION FROM AROMATIC AND SUBSTITUTED AROMATIC FUELS Progress Report, 15 Jul. 1980 - 15 Feb. 1981
T. W. Lester, J. F. Merklin, and C. M. Sorensen Mar. 1981 12 p refs
(Contract DE-AC02-80ER-10677)
(DOE/ER-10677/1) Avail: NTIS HC A02/MF A01

The opposed co-axial diffusion flame burners were constructed and preliminary experiments were conducted, using CO, CH4 and hydrogen as fuels. The opposed burners were mounted vertically and were moved independently or in tandem in the vertical direction as well as moved horizontally to facilitate spatial probing, both optical and chemical. Preliminary flame temperature measurements indicate the temperature can be varied by at least 500 K by varying the fuel flowrate and the fuel oxidizer/diluent ratio. A flow regulation system employing critical orifices was constructed to provide accurate monitoring of the fuel, oxidizer and diluent gases. The critical orifices were helium. The sample probe was constructed and a number of analytical procedurees were calibrated. The major components of the photon correlation light scattering system were obtained, tested, and linked together in the experimental configuration. DOE

N81-28216# California Univ., Riverside. Statewide Air Pollution Research Center.
EXPERIMENTAL PROTOCOL FOR DETERMINING OZONE REACTION RATE CONSTANTS Interim Report
James N. Pitts, Jr., Arthur M. Winer, Dennis R. Fitz, Sara M. Aschmann, and Roger Atkinson Mar. 1981 41 p refs
(Grant EPA-R-806661)
(PB81-171647; EPA-600/3-81-024) Avail: NTIS HC A03/MF A01 CSCL 07D

An experimental protocol for the determination of room temperature rate constants for the reactions of ozone with chemicals in the gas phase was developed and is described in detail. The experimental technique is based upon monitoring the decay of ozone (initially present at approximately 1 ppm) in the presence and absence of known excess concentrations of the test compound, with pure air as a diluent gas. The ozone reaction rate constants are then calculated from the dependence of the observed ozone decay rates on the concentration of the test compound. GRA

N81-28217# National Bureau of Standards, Washington, D.C. High Temperature Processes Group.
MOLECULAR CHEMISTRY OF INHIBITED COMBUSTION SYSTEMS Final Report, May 1977 - May 1979
J. W. Hastie and D. W. Bonnell Dec. 1980 181 p refs
(DA Proj. 1L1-61102-BH-57)
(PB81-170375; NBSIR-80-2169) Avail: NTIS HC A09/MF A01 CSCL 21B

High pressure sampling mass spectrometry and optical spectroscopic methods were applied to the molecular characterization of phosphorus containing flames. The key process controlling flame inhibition and enhancement is identified as. HPO2 · H H2O · PO. Thermodynamic data are presented for NaPO2 and LiPO2 which are present in Li/Na containing flames. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-28218 British Library Lending Div., Boston Spa (England).
DESIGN AND PRODUCTION OF THIN-WALLED ZINC PRESSURE DIECASTINGS, PART 1
L. deLuisMartin (Centro Nacional de Investigaciones Metaluraicas) Feb. 1981 27 p Transl. into ENGLISH from Colado, v. 11, no. 4, 1978 p 105-113
(BLL-RTS-12172-Pt-1) Avail: British Library Lending Div., Boston Spa, England

The usage of zinc pressure diecastings is promoted to make them more competitive with alternative materials notably injection moulded plastics. The production of large components of reduced weight with thin walls at a quality level which will minimize finishing by the application of electrolytic coatings is proposed. The most significant surface defects in thin walled components are the cold spots; they can be eliminated by improving the design of the feeding system, raising the die temperatures, providing larger overflows, and accurately regulating the die temperature. E.D.K.

N81-28219 California Univ., Berkeley.
CORROSION OF IRON Ph.D. Thesis
Clarence Garlan Law, Jr. 1980 152 p
Avail: Univ. Microfilms Order No. 8113104

Problems relevant to the electrochemical aspects of iron are treated. In the first problem, a model was developed for the anodic dissolution of iron in a sulfuric acid solution. Current and potential distribution validate experimentally obtained z shaped polarization curves. In the second problem mass transfer rates on rotating disks and rings are calculated when the flow regime may vary from laminar near the center to fully developed turbulent flow near the periphery. These results are subsequently used in a model which calculates corrosion rates on a disk rotating in sea water. On a completely different topic the current and potential distributions on a dropping mercury electrode are calculated before the limiting current. Results are generated in terms of two dimensionless parameters. Dissert. Abstr.

N81-28220 Columbia Univ., New York.
A MODEL BASED INVESTIGATION OF ELASTIC CONSTANTS IN ALLOYS Ph.D. Thesis
Joey Shao 1981 159 p
Avail: Univ. Microfilms Order No. 8113558

A lattice energy model based on a sum of interatomic Mie type potentials, atomic shear distortion, and bond bending constraints was developed to describe the elastic constants in metals with the objective of predicting the elastic constants of alloy phases. The use of the pair potential and atomic quadrupole distortion allows prediction of the elastic constants C' and C-11 of fcc transition metals correctly to within a maximum deviation of 30% from experiment and accounts for the correct violation of the Cauchy relations. This same model calculates the elastic constants of the bcc alkali metals in good agreement with the observed values using reasonable potential experiments. However, to obtain agreement with the elastic constants of bcc transition metals bond bending constraints indicating partial covalency effects are required. Dissert. Abstr.

N81-28221 Houston Univ., Tex.
IN-SITU CHARACTERIZATION OF Ni-Cw/SiO2 CATALYSTS Ph.D. Thesis
Timothy Shaun Cale 1980 214 p
Avail: Univ. Microfilms Order No. 8112879

Magnetization vs. field data were taken at 77 K and 298 K. Superposition allowed the determination of crystallite composition, while saturation gave reducibility and particle size. Segregation was concluded. The surface compositions were determined from hydrogen chemisorption at 298 K, and ranged up to 80% copper. Qualitative agreement with segregation models was obtained. Critical to the analysis was the consideration of mass balance limitations which is often not dealt with. Cyclopropane/H2 kinetics indicated no large scale clustering of the surface nickel. The effect of alloying was both geometric and electronic. Apparently, activity governed by geometric effects limiting the formation of a diadsorbed intermediate, while selectivity is governed by a ligand effect. The results imply that previous conclusions indicating surface bulk homogeneity for dispersed systems are unreasonable. Dissert. Abstr.

N81-28222 Minnesota Univ., Minneapolis.
SOLUTION CHEMISTRY OF LOCALIZED CORROSION OF STAINLESS STEELS Ph.D. Thesis
Eileen Mary Venzon 1981 213 p
Avail: Univ. Microfilms Order No. 8115056

The chemical conditions of the solutions produced within artificial corrosion pits and 18/8 stainless steels were investigated. Pits were artificially initiated in the steel samples and corrosion was induced by polarization of the sample in 0.1 N NaCl. The research included chemical analyses of the solutions withdrawn from the corrosion pits and Auger electron spectroscopy of the stainless steel surface before and after corrosion. The results showed that preferential dissolution of iron occurs at potentials below -+0.85 V vs. SCE which is the corrosion potential of chromium. A chromium rich, iron depleted surface layer is formed. Dissert. Abstr.

N81-28223 Minnesota Univ., Minneapolis.
HYDROGEN EMBRITTLEMENT IN TWO ALPHA/BETA TITANIUM ALLOYS UNDER SUSTAINED AND FATIGUE LOADINGS Ph.D. Thesis
Neville Reid Moody 1981 204 p
Avail: Univ. Microfilms Order No. 8115010

The results showed that there were a number of simularities between the two loadings with respect to hydrogen effects to threshold behavior. However, differences did exist in fracture mechanisms. From these results theoretical threshold models were developed for both loadings, which related the effects of temperature, hydrogen concentrations, microstructure, stress state, and solubility on the fracture process. Dissert. Abstr.

N81-28224 Pennsylvania State Univ., University Park.
CHEMICAL PROPERTIES OF SELECTED NICKEL (2) AND COPPER (2) HYDROXYOXIME SOLVENT EXTRACTION SYSTEMS Ph.D. Thesis
Mark Edward Keeney 1981 330 p
Avail: Univ. Microfilms Order No. 8112816

A comprehensive literature review to date of the reported transition metal hydroxyoxime complexes and a detailed analytical and spectral study of the copper (II) and nickel (II) complexes with LIX63 oxime (5,8-diethyl-7-hydroxy-6-dodecanone oxime; [H2box] and LIX65N oxime (2-hydroxy-5-nonly-benzophenone oxime; [H2box] are presented with emphasis on complex structure and reactivity. A discussion of the role of phase transfer and micellar catalysis in hydrometallurgical solvent extraction and an investigation of the chemical and thermal properties of [H2ox] and [H2box] are included. Dissert. Abstr.

N81-28225 California Univ., Berkeley.
INVESTIGATION OF THE METAL CUTTING PROCESS USING ACOUSTIC EMISSION SIGNAL ANALYSIS Ph.D. Thesis
Elijah Kannatey-Asibu, Jr. 1980 154 p
Avail: Univ. Microfilms Order No. 8113089

Theoretical relationships are drawn between emission signals and the metal cutting process parameters by relating the energy content of the acoustic emission (AE) signal to the plastic work of deformation which generates the emission signals. A method is proposed whereby (1) AE generated from the shear zone is kept constant while that from contact along the tool face is varied and (2) AE from both the shear zone and tool face are kept constant with changing contact on the flank face. Statistical techniques are investigated as a tool for extracting more sensitive information inherent in the random emission signals. Dissert. Abstr.

N81-28226 California Univ., Berkeley.
FINITE ELEMENT MODELING OF METALWORKING PROCESSES FOR THERMO-VISCOPLASTIC ANALYSIS Ph.D. Thesis
Nuno Manuel Rosas Da Silva Rebelo 1980 231 p
Avail: Univ. Microfilms Order No. 8113169

Strain rate effects are incorporated in the infinitesimal theory of rigid plastic materials, based on experimental evidence. A theory of dissipative materials based in rational thermodynamics is adapted to rigid-thermoviscoplastic analysis of metal forming problems. Internal structure changes due to plastic deformation are described by means of internal parameters. A finite element scheme is developed implementing the above theory. An implicit scheme is used for the time integration of heat transfer equations, which is coupled to the plasticity equations. The formulation is tested with the simulation of cylinder and ring compressions, both at room and high temperatures. The calculated results agree with the experimental evidence available and establish the applicability of the method to hot forging. Strain-rate effects are investigated in the punch stretching of sheet metals. Dissert. Abstr.

N81-28227 Connecticut Univ., Storrs.
INFLUENCE OF HIGH ENERGY VIBRAMILLING ON THE ANNEALED AND SINTERED STRUCTURES AND PROPERTIES OF AN Fe-27 CHROMIUM AUSTENITIC P/M STEEL Ph.D. Thesis
Aspi Nanabhai Patel 1981 186 p
Avail: Univ. Microfilms Order No. 8115388

High energy vibratory ball milling is used to intermix the alloying constituents, iron, nickel, and chromium, to produce a blended powder consisting of individual particles having a striated microstructure of alternate layers of iron, nickel, and chromium. Sintering and homogenization are enhanced by the short diffusion paths, the intimacy of contact between iron, nickel, and chromium, and release of stored energy in the powder. Dissert. Abstr.

N81-28228 Illinois Univ. at Urbana-Champaign.
EFFECT OF NONEQUILIBRIUM DEFECTS DUE TO PHASE TRANSFORMATION ON DIFFUSION IN BETA ZIRCONIUM Ph.D. Thesis
Bhanumathi Chelluri 1981 121 p
Avail: Univ. Microfilms Order No. 8114400

The effect of the hcp yield bcc phase transformation on the anomalous diffusion characteristics of bcc zirconium has been investigated in this study. Sn 113 and Fe 59 tracers were used to typify the diffusing nature of self and fast diffusing atoms. A differential measurement of diffusion in two samples was carried out under very different preannealing conditions but otherwise identical states of diffusion time and temperature. In the first set of experiments, one of the samples was annealed for lengthy periods of time (approximately 20-30 hours) at premelting temperatures (approximately 1550 C) prior to diffusion (at lower temperature in the bcc phase). This was done in an attempt to decrease the defect concentration produced by the phase transformation. Dissert. Abstr.

N81-28229 Rutgers - The State Univ., New Brunswick, N. J.
CHARACTERIZATION OF INTERFACIAL REACTIONS IN SILVER-TO-ALUMINA BONDING, WITH A SUPPLEMENT: A GENERAL MODEL FOR METAL TO CERAMIC BONDING Ph.D. Thesis
Shung-Huel Chang 1981 224 p
Avail: Univ. Microfilms Order No. 8115203

The interfacial reactions between silver and alumina in the absence of glassy bond were investigated in an effort to develop a bonding model for this system. An attempt was made to characterize the progress of bonding silver to aluminum oxide in powder, single crystal, and multicrystalline ceramic forms as applied at a wide range of thickness of the metal layer and then heating in air atmospheres to different levels of temperature. Silver compounds were also tried in order to raise the decomposition temperature of the oxygen containing compound and hence to enhance the bonding reaction at higher temperature. The mechanisms of bonding directly between silver and alumina and bonding enhanced by Mo were proposed. Dissert. Abstr.

N81-28230*# National Aeronautics and Space Administration, Washington, D. C.
METAL WHISKERS
Ernst Hutzenlaub and Friedrich Unterreithmeir Jun 1981 19 p Transl. into ENGLISH of Phys.-Met. Forschungslabor (Munich), p 1-20 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Wilhelm Herm. Mueller and Co., KG (Munich)
(Contract NASw-3199)
(NASA-TM-76583) Avail: NTIS HC A02/MF A01 CSCL 11F

The production and properties of polycrystalline metal whiskers, their processing and some examples of application as heat exchangers, catalysts or catalyst carriers, catalysts for the Fischer-Tropsch synthesis, and other applications are discussed. A metal carbonyl such as iron or nickel is produced by thermal decomposition in a magnetic field. The needle shaped whiskers are marked by great mechanical and thermal stability. In contrast to monocrystalline whiskers they can be produced rapidly and in great quantity. E.D.K.

N81-28231* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BURNER RIG EVALUATION OF THERMAL BARRIER COATING
Michael A. Gedwill Feb. 1981 23 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81684; DOE/NASA/2593-26; E-712) Avail: NTIS HC A02/MF A01 CSCL 11F

Eight plasma sprayed bond coatings were evaluated for their potential use with ZrO2-Y2O3 thermal barrier coatings (TECs) which are being developed for coal derived fuel fired gas turbines. Longer TBC lives in cyclic burner rig oxidation to 1050 C were achieved with the more oxidation resistant bond coatings. These were Ni-14.1Cr-13.4Al-0.10Ar, Ni-14.1C4-14.4Al-0.16Y, and Ni-15.8Cr-12.8Al-0.36Y on Rene 41. The TBC systems performed best when 0.015-cm thick bond coatings were employed that were sprayed at 20 kW using argon 3.5v/o hydrogen. Cycling had a more life limiting influence on the TBC than accumulated time at 1050 C. Author

N81-28232*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CORROSION FATIGUE OF INCONEL 718 AND INCOLOY 903
D. B. Franklin and E. E. Nelson Jun. 1981 16 p refs
(NASA-TM-82426) Avail: NTIS HC A02/MF A01 CSCL 11F

Corrosion fatigue tests were conducted on Inconel 718 and Incoloy 903 in distilled water, 500 ppm NaCl, and 3.5% NaCl. Results were compared to the endurance limit in air. For Inconel 718, the corrosion fatigue strength (CFS) IN 3.5% NaCl WAS 328 MPa or 75 percent of the endurance limit. For Incoloy 903, the CFS ranged from 234 MPa in distilled water (68 percent of the endurance limit) to 103 MPa in 3.5% NaCl (30 percent of the endurance limit). Results indicate that, for components which have limited fatigue life, an evaluation of the combined effects of fatigue and the corrosive atmosphere must be considered in projecting useful lifetimes. Author

N81-28233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION AND FRICTION OF TRANSITION METALS IN CONTACT WITH NONMETALLIC HARD MATERIALS
Kazuhisa Miyoshi and Donald H. Buckley 1981 19 p refs Presented at Intern. Conf. on the Sci. of Hard Mater., Moran, Wyoming, 23-28 Aug. 1981
(NASA-TM-82605; E-853) Avail: NTIS HC A02/MF A01 CSCL 11F

Sliding friction experiments were conducted with the metals yttrium, titanium, tantalum, zirconium, vanadium, neodymium, iron, cobalt, nickel, tungsten, platinum, rhenium, ruthenium, and rhodium in sliding contact with single crystal diamond, silicon carbide, pyrolytic boron nitride, and ferrite. Auger electron spectroscopy analysis was conducted with the metals and nonmetals to determine the surface chemistry and the degree of surface cleanliness. The results of the investigation indicate the adhesion and friction of the transition metals in contact with diamond, silicon carbide, boron nitride, and ferrite are related to the relative chemical activity of the metals. The more chemically active the metal, the higher the coefficient of friction and the greater amount of transfer to the nonmetals. E.D.K.

N81-28234# Grumman Aerospace Corp., Bethpage, N.Y.
EFFECT OF TWO-STAGE AGING ON MICROSTRUCTURE

OF 7075 ALUMINUM ALLOYS Final Report
John M. Papazian Apr. 1981 56 p refs
(Contract N00019-79-C-0285)
(AD-A100466; RE-627) Avail: NTIS HC A04/MF A01 CSCL 11/6

Differential scanning calorimetry (DSC) and transmission electron microscopy (TEM) were used to establish the microstructural effects of various multistage aging treatments on aluminum alloy 7075. DSC was used to characterize the matrix microstructure while TEM was used to characterize the grain boundary precipitates. The aging treatments were in five categories: isochronal pre-aging, isothermal pre-aging, final again at 150 C, commerical type two-stage aging treatments, and retrogression and re-aging (RRA) treatments. Author (GRA)

N81-28235# Naval Research Lab., Washington, D. C. Material Science and Technology Div.
A COMPARISON OF THE CORROSION AND STRESS CORROSION RESISTANCE OF TWO DEPLETED URANIUM ALLOYS, DU-0.75 Ti AND DU-2 Mo Interim Report
Patricia P. Trzaskoma 27 May 1981 17 p refs
(AD-A100364; NRL-MR-4518) Avail: NTIS HC A02/MF A01 CSCL 19/1

Considerable experimental work concerning the corrosion rates, stress corrosion behavior, and effects of corrosion on the mechanical properties of depleted uranium alloys has been performed. In this study data for two alloys, DU-0.75 Ti and DU-2 Mo, in three environments have been collected and compared in order to determine whether there are significant differences in their corrosion characteristics and whether these differences warrant a choice of alloy for kinetic energy penetrator applications. In moist air the corrosion rates of the two alloys are low and appear to be of little consequence with respect to this application. In salt fog the corrosion rate of DU-3/4 Ti increases sharply. The weight loss in thirty days is about 7 percent of the total weight. No data was found for the molybdenum alloy in salt fog. Further experimental work is suggested.
Author (GRA)

N81-28236# Army Tank-Automotive Command, Warren, Mich.
A STUDY OF MECHANICAL ALLOYING OF METAL POWDERS Final Technical Report, Oct. 1977 - Sep. 1978
T. K. Wassel and L. Himmel (Wayne State Univ.) May 1981 95 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A100353; TACOM-TR-12571) Avail: NTIS HC A05/MF A01 CSCL 11/6

This investigation was undertaken primarily to obtain information concerning the chemical and structural homogeneity of mechanically alloyed powders and to determine under what conditions, if any, true solid solutions may be formed. Four different alloy systems were selected for study: (1) 50 w/o Cr - 50 w/o Mo, (2) Type 316 stainless steel, (3) 20.8 w/o Mn 79.2 w/o Bi, and (4) a Beta-Ti alloy (Ti-11Cr-8Mn-5Mo-3Al). In both the Cr-Mo system and Type 316 stainless steel system, it was established by x-ray diffraction methods that the elemental components had become interdispersed on an atomic scale as a result of high-energy milling, but that a minimum threshold speed is necessary to obtain a significant degree of alloying. However, annealing studies on the milled powders provided strong indications that the solid solutions formed by mechanical alloying are very inhomogeneous from a chemical and structural point of view. Milling difficulties were encountered with the Beta-Ti and Bi-Mn powder systems which precluded any conclusions pertaining to structural or chemical homogeneity in these systems. In both the Bi-Mn and Beta-Ti systems, the tendency toward cold-welding and/or diffusion welding of the particles was so pronounced that it was not possible to achieve a proper balance of cold-welding and particle fracturing in order to mechanically alloy component metals. GRA

N81-28237# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
PREDICTION OF THE MECHANICAL RESPONSE OF A HIGH TEMPERATURE SUPERALLOY, RENE 95 Interim Report, Sep. 1978 - Jul. 1980
D. C. Stouffer, L. Papernik, and H. L. Bernstein Wright-Patterson AFB, Ohio AFWAL Dec. 1980 64 p refs
(Contract F33615-78-C-5199; AF Proj. 2307)
(AD-A100290; AFWAL-TR-80-4184) Avail: NTIS HC A04/MF A01 CSCL 11/6

The mechanical response of Rene 95 at 650 C. (1200 F) is predicted by the three different theories. First, the state variable model by Bodner and his coworkers is examined. A method is developed to calculate the state variable history for the Rene 95 data. This leads to a new presentation for the state variable and a direct method to determine some of the material parameters. Second, it is found that creep and stress relaxation can be correlated with isochronous curves; thus, the theory of Rabotnov and Papernik is examined. The model is extended to cyclic histories and a representation is developed specifically for Rene 95. Third, the model developed by Laflen and Stouffer for another alloy is extended to Rene 95. It is also used to predict reverse plastic flow developed during cyclic histories. All models were found to reproduce the stress strain and creep response very well. The models were also used to predict the cyclic behavior and stress relaxation. In general it is found that none of the models can adequately predict phenomena arising from damage such as tertiary creep. The study is concluded that a point by point comparison of the models. GRA

N81-28238# Massachusetts Inst. of Tech., Cambridge. Lab. for Manufacturing and Productivity.
THE EFFECTS OF ION IMPLANTATION ON FRICTION AND WEAR OF METALS Progress Report, Jan. 1980 - Apr. 1981
Nam P. Suh and Sharon R. Shepard May 1981 185 p refs
(AD-A101173) Avail: NTIS HC A09/MF A01 CSCL 11/6

The effect of ion implantation on the friction and wear behavior of metals was investigated. Experiments were conducted with iron, titanium, and copper implanted with nitrogen ions, iron implanted with aluminum ions, and copper implanted with zinc ions. The significant reduction in friction and wear of the iron and titanium systems is attributed to a hard layer formed during the ion implantation process. This hard layer minimizes plowing and subsurface deformation and hence reduces the delamination wear process, i.e., crack nucleation, crack propagation, and the formation of delamination wear sheets. A finite element model of an elastic semi-infinite solid under the contact of a stationary rigid asperity showed that the hard layer does not change the subsurface stress distribution by supporting the load, but rather that this thin layer decreases the plowing component of friction. The model predicts that this decrease in the friction coefficient in turn, substantially reduces subsurface deformation and thus wear. The implanted copper specimens which did not appear to have a hard surface layer showed little improvement in their tribological behavior over the unimplanted copper. GRA

N81-28239# New Jersey Inst. of Tech., Newark
MERCURY CADMIUM TELLURIDE SPUTTERING RESEARCH Annual Technical Report
Roy H. Cornely 1 Jun. 1981 19 p refs
(Grant AF-AFOSR-3249-77; AF Proj. 2306)
(AD-A101039; AFOSR-81-0531TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

A large number of 5-10 micron thick n and p-type films on Si and CdTe substrates were prepared by Hg vapor rf triode-sputtering using pressed-powder targets. The targets had different percentages of CdTe particles and thus films with the CdTe mole percent (x values) between 0.18 and 0.27 were obtained. It was demonstrated that the grain size and mobility of the sputtered polycrystalline films, with a high degree of (111) crystal orientation, could be greatly increased by annealing the films at 553-623 degrees Kelvin in a Hg atmosphere. For example, x – 0.27 films had as-sputtered electron mobilities less than 20 percent of ideal bulk-crystal material at 300 degree Kelvin and less than 4 percent at 85 degree Kelvin with free electron concentrations 20 times intrinsic material at 85 degrees. After annealing at 553 degrees in 74 mm pressure of Hg, the electron mobilities were 71.5 and 16.5 percent of ideal values at 300 and 85 degrees respectively with carrier concentrations in the 10 to the sixteenth per cubic cm range. Similar results were obtained using CdTe and Si substrates and for other compositions. For films with 0.18 CdTe mole percent, electron mobilities of 24,000 cm squared per volt second were measured at 85 degrees. Two step annealing processes, with separate temperatures for

grain size enlargement and stoichiometry adjustment, and low temperature heat treatments for preventing peeling by grading the Si-(Hg,Cd)Te interface appear necessary for further optimization of the annealing effects. Author (GRA)

N81-28240# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Div.
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF 0.1C STEEL WITH Nb M.S. Thesis
Jing-Sheng Gau Apr. 1981 67 p refs
(Contract W-7405-eng-48)
(LBL-12058) Avail: NTIS HC A04/MF A01

Efforts were made to strengthen the ferrite matrix by enhancing precipitation through the presence of strong carbide forming mixture rule, an attempt to affect the stress in the ferrite at the ultimate strength of martensite. The effect of processing variables on the mechanical properties and resultant microstructure were also investigated. DOE

N81-28241# California Univ., Davis. Dept. of Mechanical Engineering.
IMPURITY EFFECTS ON THE KINETICS OF SINTERING OF METAL POWDERS Final Report
P. K. Higgins and Z. A. Munir Sep. 1980 241 p refs
(Contract W-7405-eng-48)
(UCRL-15337) Avail: NTIS HC A11/MF A01

Metal-oxide systems were divided into four distinct groups and the palladium-palladium oxide system was analyzed. Evaluation of surface area reduction data of pellets sintered in air between 773 and 898 K results in a mechanism characteristic exponent, N, between 6.2 and 6.8 and an activation energy of 14.1 + or - 0.4 kcal/mole. Lack of shrinkage and the low vapor pressure of palladium in the solid state lead to the conclusion that surface diffusion is the rate controlling sintering mechanism. Specimens sintered in the absence of a surface oxide layer in the temperature range between 773 and 1148 K incurred shrinkage with resulting N values between 5.6 and 6.5. Those specimens sintered in vacuum between 773 and 898 K possess and activation energy of 63.9 + or - 0.5 kcal/mole. When compared to the literature value for grain boundary diffusion of 31.8 kcal/mole a large discrepancy is noted. DOE

N81-28242# Sandia Labs., Albuquerque, N. Mex.
COMMERCIAL APPLICATIONS OF OVERLAY COATING TECHNIQUES
D. M. Mattox 1981 9 p Presented at the Intern. Conf. on Metallurgical Coatings, San Francisco, 6 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0570C; CONF-810425-1) Avail: NTIS HC A02/MF A01

Coatings are fabricated in a number of ways and some of the important techniques are presented. The fabrication techniques are generally categorized as one which form overlay coatings where the surface region is composed of a material which differs from the bulk material and fabrication techniques which form coatings by surface modification processes where some of the bulk material is detectable in the coating. DOE

N81-28243# Pennsylvania State Univ., University Park. Dept. of Physics.
ATOM-PROBE INVESTIGATION OF A MICRO-CRACK ASSOCIATED WITH HYDROGEN IN A Fe-Ti ALLOY
Y. Kuk, T. Sakurai, and H. W. Pickering 1980 7 p Presented at the 27th Intern. Field Emission Symp., Tokyo, 7-11 Jul. 1980
(Contract DE-AC02-70ER-10430)
(CONF-800730-4) Avail: NTIS HC A02/MF A01

The formation of a microcrack and its development into a fracture were witnessed using field ion microscopy. The crack initiated at a grain boundary intersection and propagated mainly, though not entirely, along the grain boundary. Compositional analysis at a hydrogen produced microcrack in a Fe-0.29 wt % Ti alloy by the high performance time of flight atom probe showed a large amount of hydrogen at the crack and iron hydrides. In contrast, hydrogen in any form is rarely found in other surface areas, or in the bulk. DOE

N81-28244# Pennsylvania State Univ., University Park.
CLUSTER FORMATION AND ELEVATED TEMPERATURE STRENGTHENING OF IRON ALLOYS BY Ti
H. W. Pickering 1980 9 p refs Presented at the 27th Intern. Field Emission Symp., Tokyo, 7-11 Jul. 1980
(Contract DE-AC02-79ER-10430)
(CONF-800730-5) Avail: NTIS HC A02/MF A01

A compositional analysis of a Fe-Ti alloy was carried out using a time of flight atom probe. In the subsurface atom layer region, Ti was found to be present as randomly distributed titanium atoms and to a lesser degree as clusters of Ti around impurities, such as C, N, and O. The titanium is also strongly segregated to the surface and grain boundaries. The titanium profile at the surface extends over 20 atom distances into the bulk. In contrast oxygen, which also segregates and combines to form mainly TiO and TiO2 is confined to a few atom layers of the surface. This direct observation of of clustering supports a strengthening mechanism proposed by Cuddy and co-workers to explain anomolous mechanical property data observed at somewhat elevated temperatures in Ti-bearing iron alloys. DOE

N81-28245# Pennsylvania Univ., Philadelphia.
KINETICS OF THE DESULFURIZATION OF MOLTEN IRON Final Report
D. R. Gaskell Mar. 1981 17 p refs
(Contracts EM-78-S-02-4725; DE-AS02-78CS-40153)
(DOE/CS-40153/T1) Avail: NTIS HC A02/MF A01

Experimental work involved the fabrication of impervious slip-cast CaO crucibles, measurement of the rate of desulfurization of liquid iron by solid CaO and measurement of the rate of desulfurization of liquid iron by CaO-saturated liquid FeO. Above $0.087 < wt\ \% S < 0.67$, the activity of FeS is high enough to form a liquid phase in the system CaO-Fe-S. With lower sulfur levels, CaO does not cause any desulfurization of the liquid iron. When CaO-saturated liquid FeO is brought into contact with a liquid Fe-S alloy a rapid initial rate of desulfurization occurs due to surface tension-induced local convection at the slag-metal interface. After this initial period, the rate of desulfurization is determined by diffusion of sulfur in the metal. No change occurs in the oxygen content of the metal during desulfurization and hence the half cell reactions occurring in the electrochemical transfer process are [Fe] yields Fe (+2) + 2e(-) and [S] + 2e(-) yields S(-2). Addition of CaF2 to the CaO-saturated slag has no effect on the desulfurization. DOE

N81-28246# Brookhaven National Lab., Upton, N. Y.
OUTGASSING RATE OF THE COPPER-PLATED BEAM TUBE FOR ISABELLE
H. C. Hseuh and E. F. Gaudet 1981 3 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(Contract DE-AC02-76CH-00016)
(BNL-29217; CONF-810314-96) Avail: NTIS HC A02/MF A01

The ultrahigh vacuum system of the intersecting storage accelerator ISABELLE consists of two interlaced rings of stainless steel beam tubes with a circumference 2-1/2 miles each. In order to obtain a good heat conduction during bakeout and to reduce the resistive wall instability during beam operation, a 1mm thick copper coating is electroplated to the outer surface of this 1.5 mm thick beam tube. In order to minimize the beam loss due to beam-gas collision, the pressure inside the beam tube is required to be 1 x 10 to the -11 power Torr or less. DOE

N81-28247# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
STUDY OF DIFFUSION OF OXYGEN IN DILUTE VANADIUM ALLOYS USING SOLID ELECTROLYTIC CELLS
Roberto deAvillez and Carl Altstetter 1981 14 p refs Presented at the AIME Ann. Meeting, Chicago, 22 Feb. 1981
(Contracts DE-AC02-76ER-01198; EY-76-C-02-1198)
(DOE/ER-01198/1343; CONF-810203-9) Avail: NTIS HC A02/MF A01

The bulk diffusivity of oxygen was measured as a function of temperature in dilute vanadium alloys. The oxygen content, which is initially uniform in the vanadium based alloy, drains into the zirconium sink as a function of annealing time. After a

short transient, the rate of cell emf change is directly proportional to the diffusivity of oxygen in the alloy. Substitutional solutes in vanadium were chosen on the basis of their atomic sizes in vanadium and the heats of formation of their oxides. Oxygen diffusion results were obtained for nickel, chromium, niobium, tantalum, titanium, zirconium, and hafnium as binary solute additions of up to 4 at. percent. The oxygen diffusivity results are compared with those for niobium-based alloys. Interpretations of the results are made using two models for the thermodynamics and kinetics of trapping of interstitial atoms by substitutional solute atoms. DOE

N81-28248# Pennsylvania State Univ., University Park. Dept. of Materials Science.

HIGH-PERFORMANCE ATOM-PROBE FIELD ION MICROSCOPE STUDY OF SEGREGATION AND HYDROGEN CRACKING IN Fe-0.29 Ti

Y. Kuk, H. W. Pickering, and T. Sakurai 1980 9 p refs Presented at the Intern. Conf. on Effects of Hydrogen on Materials, Jackson Lake Lodge, Wyo., 26-31 Aug. 1980

(Contract DE-AC02-79ER-10430)

(DOE/ER-10430/7; CONF-800850-5) Avail: NTIS HC A02/MF A01

With the greatly improved resolution now availale in energy focused atom probes, hydrogen can be readily resolved even when combined with metals having several isotopes. In addition to finding that H, H2, FeH and TiH2 accumulate at segregated grain boundaries in Fe-0.29 wt percent Ti, a striking observation was made; the formation and propagation of a microcrack when the (field ion microscope) tip was exposed to hydrogen gas at elevated temperature. A small crack was first noticed at a grain boundary intersection during field ion imaging. This was an open crack, formed by detachment of metal between the intersecting grain boundaries, which was observed to be much larger after the tip was reheated to 1300 K for 10 min. in the presence of 100 Pa H2. This crack could be easily reduced in size by gradually field evaporating the surface. Its propagation was repeated several times and reproducible results were obtained. DOE

N81-28249# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

CORROSION OF METALS IN COAL CHAR ENVIRONMENTS

T. F. W. Foerster (Standard Oil Co. of Calif., San Francisco), A. V. Levy, and J. S. Newman Jan. 1981 36 p refs Presented at the NACE Intern. Conf. on High Temp. Corrosion, San Diego, Calif., 2-6 Mar. 1981

(Contract W-7405-eng-48)

(LBL-12152; CONF-810347-1) Avail: NTIS HC A03/MF A01

It is demonstrated that a layer of coal char covering a metal surface affects the sulfur and oxygen partial pressures at the metal surface and thus the rate and extent of corrosion. Experiments demonstrating the effect of char composition and depth and bulk gas composition and flow rate on the rate of sulfidation are described. DOE

N81-28250# Technical Research Centre of Finland, Espoo. Metals Lab.

INTEGRANULAR CORROSION: THE RELIABILITY OF THE ELECTROCHEMICAL POTENTIOKINETIC REACTIVATION METHOD

T. Purra Jan. 1980 21 p refs

(VTT-MET-64; ISBN-951-38-0882-3; ISSN-0355-6395) Avail: NTIS (US Sales only) HC A02/MF A01; DOE Depository Libraries

The reliability and reproducibility of the electrochemical potentiokinetic reactivation method (the EPR-method) in testing the susceptibilty of steels to intergranular corrosion was studied. Two series of heat treated specimens of the steel AISI 304 were tested using the standard acid copper sulphate test (the Strauss test) and the EPR-method. A clear correspondence was found between the results measured by the Strauss test and by the potentiokinetic reactivation method, alltough the latter seemed to move the peak of the sensitization curves towards higher temperatures. The reproducibility of the EPR-tests was also found to be good. DOE

N81-28251# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

HYDROGEN IN TITANIUM ALLOYS

G. W. Wille and J. W. Davis Apr. 1981 54 p refs

(Contract DE-AS02-77ET-52039)

(DOE/ET-52039/2) Avail: NTIS HC A04/MF A01

The titanium alloys that offer properties worthy of consideration for fusion reactors are Ti-6Al-4V, Ti-6Al-2Sn-4Zr-2Mo-Si (Ti-6242S) and Ti-5Al-6Sn-2Zr-1Mo-Si (Ti-5621S). The Ti-6242S and Ti-5621S are considered because of their high creep resistance at elevated temperatures of 5000 C. Also, irradiation tests on these alloys have shown irradiation creep properties comparable to 20% cold worked 316 stainless steel. These alloys would be susceptible to slow strain rate embrittlement if sufficient hydrogen concentrations are obtained. Concentrations greater than 250 to 500 wppm hydrogen and temperatures lower than 100 to 1500 C are approximate threshold conditions for detrimental effects on tensile properties. Indications are that at the elevated temperature - low hydrogen pressure conditions of the reactors, there would be negligible hydrogen embrittlement. DOE

N81-28252*# National Bureau of Standards, Washington, D.C. National Measurement Lab.

NBS: NONDESTRUCTIVE EVALUATION OF NONUNIFORMITIES IN 2219 ALUMINUM ALLOY PLATE: RELATIONSHIP TO PROCESSING Technical Report, Aug. 1979 - Sep. 1980

L. Swartzendruber, W. Boettinger, L. Ives, S. Coriell, D. Ballard, D. Laughlin, R. Clough, F. Biancanieilo, P. Blau, and J. Cahn Dec. 1980 246 p refs Sponsored in part by NASA

(NASA-CR-164596; PB81-172348; NBSIR-80-2069) Avail: NTIS HC A11/MF A01 CSCL 11F

The compositional homogeneity, microstructure, hardness, electrical conductivity and mechanical properties of 2219 aluminum alloy plates are influenced by the process variables during casting, rolling and thermomechanical treatment. The details of these relationships wre investigated for correctly processed 2219 plate as well as for deviations caused by improper quenching after solution heat treatment. Primary emphasis was been placed on the reliability of eddy current electrical conductivity and hardness as NDE tools to detect variations in mechanical properties. GRA

N81-28160# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Textile Fibers Dept.

INORGANIC ALUMINA FIBERS FOR REINFORCEMENT OF METAL CASTINGS Final Report

Ashok K. Dhingra *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 88-123 refs (For primary document see N81-28146 19-23)

Avail: NTIS HC A09/MF A01 CSCL 07/3

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-28253 California Univ., Berkeley.

SLIDING MECHANISMS FOR GRAIN BOUNDARIES CONTAINING PRE-EXISTING CAVITIES IN AlO3-SiO2 Ph.D. Thesis

Amar Pal Singh Rana 1980 105 p

Avail: Univ. Microfilms Order No. 8113168

High temperature failure in ceramics frequently involves the nucleation, growth, and coalescence of grain boundary located microcracks or cavities. Fabrication processes such as hot pressing and sintering also lead to the presence of cavities at grain boundaries. Models of grain boundary sliding when cavities are present at grain boundaries in Al2O3-SiO2 ceramics are studied using the internal friction technique. An apparatus was developed to measure internal friction and elastic modulus up to 1200 C using a sonic resonance technique, with electromagnetic transducers. Dissert. Abstr.

N81-28254 State Univ. of New York at Buffalo.
THE INJECTION MOLDING OF PHENOLIC RESIN Ph.D. Thesis
Tai-Shung Chung 1981 308 p
Avail: Univ. Microfilms Order No. 8114659

A mathematical model is proposed for the simulation of the injection molding of thermosetting systems. The model is based on the combination of the basic equations of change with the appropriate constitutive relations for the material and the relevant boundary and initial conditions for the process. The non Newtonian behavior of the fluid, the effect of temperature and degree of cure on the viscosity, and the compressibility and reactivity of the material were taken into consideration in the simulation. The theoretical analysis yields quantitative results for the requisite filling time, as well as the velocity, pressure, temperature, degree of cure, and shear rate distribution throughout the mold cavity during the entire injection molding cycle. The model may be applied to either thermoplastic or thermosetting systems. Experimental studies have been conducted with a Van Dorn reciprocating screw injection molding machine in order to test the validity of the proposed model. Results show that the theoretical predictions are in good agreement with experimental data for the cases studied for both thermoplastic and thermosetting resins. Dissert. Abstr.

N81-28255 Wisconsin Univ. - Madison.
OSCILLATORY FLOW BIREFRINGENCE OF DILUTE POLYMER SOLUTIONS: CONCENTRATION DEPENDENCE AND HIGH FREQUENCY BEHAVIOR Ph.D. Thesis
Timothy Patrick Lodge 1980 426 p
Avail: Univ. Microfilms Order No. 8110088

The technique of oscillatory flow birefringence (OFB) was used to study the dynamics of conformational change for synthetic polymers in solution. The majority of the work is aimed at elucidating the concentration dependence of the OFB properties in the dilute and semi-dilute regimes; other results are concerned with the high frequency OFB behavior as a function of concentration, molecular weight, solvent, and polymer structure. Dissert. Abstr.

N81-28256 Connecticut Univ., Storrs.
A LASER LIGHT SCATTERING STUDY OF THE KINETICS OF THE EMULSION POLYMERIZATION OF METHYL METHACRYLATE IN AQUEOUS MEDIUM Ph.D. Thesis
Tor Henrik Palmgren 1981 118 p
Avail: Univ. Microfilms Order No. 8115309

A modified Brice-Phoenix 2000 DM light scattering photometer was used for the in situ detection of the polymerization process. A He/Ne laser was employed as the scattering light source allowing for high signal stability. The signals were detected simultaneously at two photomultiplier tubes, one at 0 deg and the other at 90 deg to the laser beam. The differential signal was subsequently recorded. Thus external noise could be minimized by subtraction. The differential signal was recorded as a function of time and converted to Rayleigh ratios. Theoretical computations based on the Hansen-Ugelstad theory and carried out for comparison. The results indicate that capture and coagulation can be ruled out during the first few seconds of polymerization. It was also shown that coagulation plays an important role later in the process. Evidence was found for what could be called a binary solvent effect, where a higher monomer to water ratio would result in a higher solubility of the oligomeric chains, thus allowing oligomers to grow longer the higher the monomer concentration. Dissert. Abstr.

N81-28257 Washington Univ., Seattle.
SYNTHESIS OF POLYMERIC CHELATES Ph.D. Thesis
Horng Chin Yeh 1981 160 p
Avail: Univ. Microfilms Order No. 8113483

Methods were devised for the synthesis and characterization of polymers containing a small percentage of acetylacetonate (acac) ligands. Three types of polymers were studied: (1) diene based copolymers containing a small amount of acac ligands pendant along the polymer chain; (2) polystyrene containing a known number of pendant acac groups; (3) poly (dimethylsiloxane) containing a known number of acac groups randomly distributed along the chain; and poly(dimethylsiloxane) having acac groups at the chain ends. The polymers were studied for both the amount of acac ligand ad their cross linking reactions with selected transition metals by ultraviolet spectroscopy (UV). The UV analyses of the polymer systems were compared with their monomer analogs, and the results confirm that the chelate cross linking reactions of polymer compounds are similar to those of model compounds. Dissert. Abstr.

N81-28258 Utah Univ., Salt Lake City.
A STUDY OF THE THERMAL DECOMPOSITION OF A POLYURETHANE POLYMER Ph.D. Thesis
Jayant Ramchandra Angal 1981 183 p
Avail: Univ. Microfilms Order No. 8115448

The polymer was characterized by elemental analysis and infrared spectroscopy prior to degradation studies. Thermoanalytical studies were carried out using a Mettler Thermoanalyzer. Degradation products were separated, identified, and quantified as a function of temperature. Low boiling volatiles, high boiling volatiles, and solid residues were studied using gas chromatography; elemental analysis, and infrared spectrometry. The analysis of several thermogravimetric experiments showed that the presence of oxygen during initial phases of decomposition did affect the polymer structure. The low boiling volatiles formed under inert and oxidative environments had almost the same qualitative makeup. However, in the presence of oxygen, most of the products were formed at higher rates at lower temperatures. No nitrogen containing compounds were observed among the low boiling volatiles released below 400 C. The results have shown from the results of the low boiling volatiles and the direct probe analysis that most of these products were formed as a result of the polyol decomposition. Dissert. Abstr.

N81-28259 Seton Hall Univ., South Orange, N. J.
INTERACTIONS BETWEEN SMALL IONS AND QUATERNIZED POLYIMINE SALTS BY MASS TRANSPORT AND POTENTIOMETRIC METHODS Ph.D. Thesis
Lilian Kit-Ching Leung-Louie 1980 146 p
Avail: Univ. Microfilms Order No. 8114148

Quaternary ammonium polymers of different charge density were used to study the interactions between small ions and polycations in solution. The polydimethyliminoalkyl bromides (ionenes) used were synthesized by Menschutkin reactions. Another quaternary ammonium compound used was poly(N, N-diallyldimethylammonium chloride). Tracer diffusion coefficients and activity coefficients of the small ions were determined using the capillary diffusion method and ion selective electrodes, respectively. Tracer diffusion coefficients of the sodium and calcium coions and of the sulfate counterion were determined in aqueous sodium bromide, calcium bromide or sodium sulfate solutions of the 3-3, 4-4 and 6-6 ionene bromides, or in aqueous sodium chloride, calcium chloride or sodium sulfate solutions of poly(N, N-diallyl-dimethylammonium chloride). The 3-3, 4-4 and 6-6 designations refer to the alkyl groups between the quaternized nitrogen atoms in each polyelectrolyte chain, which varies the charge density of the polyelectrolyte. Dissert. Abstr.

N81-28260# Boeing Military Airplane Development, Seattle, Wash.
RELATIONSHIP OF INTERFACIAL COMPATIBILITY TO DURABILITY OF ADHESIVE-BONDED JOINTS Final Technical Report, 1 Sep. 1978 - 1 Sep. 1980
Erick E. Peterson and Daniel B. Arnold Wright-Patterson AFB, Ohio AFWAL Mar. 1981 223 p refs
(Contract F33615-78-C-5133; AF Proj. 1457)
(AD-A100523; AFWAL-TR-80-4176) Avail: NTIS HC A10/MF A01 CSCL 13/5

Previous investigations reported reduced lap-shear strength or stress durability of some 350 F curing adhesive systems on phosphoric acid anodize (PAA) compared to Forest Products Laboratory (FPL) etch. When certain elastomer-modified primers were utilized, the reported reductions in mechanical properties were more severe. These investigations employed 0.0625 in. thick adherend machined lap-shear specimens. Various mechanisms were hypothesized to explain an apparent primer/PAA compatibility problem. This investigation determined the structure and chemistry of the PAA and FPL oxides; and investigated the mechanical properties and component interactions of bonded joints containing 350 F curing adhesive systems combined with PAA and FPL. On 0.0625 in. thick adherend machined lap-shear

specimens. FPL had greater strength. However the significant reduction in strength, reported earlier, were not substantiated. Because of the significant normal stress gradients present in this specimen other investigators have recommended that it not be employed to measure shear strength. On 0.125 in. thick adherend machined lap-shear specimens, PAA had greater shear strength. Stress durability on PAA was superior to or equal to that of FPL. Author (GRA)

N81-28261# Boston Univ., Mass. Center for Polymer Studies.

STATISTICAL MECHANICS APPLIED TO POLYMERS Final Report, 1 Oct. 1978 - 30 Sep. 1980

H. Eugene Stanley Sep. 1980 38 p refs
(Grant AF-AFOSR-3144-77; AF Proj. 2301)
(AD-A100131; AFOSR-81-0502TR) Avail: NTIS HC A03/MF A01 CSCL 07/3

This research addresses both the theoretical and experimental aspects of polymers and polymer gelation. Several fundamental advances were made in the theory of polymers by applying the renormalization group and percolation theory. New theoretical formulations include the large-cell Monte Carlo renormalization group and the position-space renormalization group. The model of correlated site percolation was considered in detail. Specific theoretical formulations include a site-bound model of gelation, an extended model of gelation, a model for sol-gel phase boundary, models for vulcanization and gelation when two types of polymer chains are involved, a model for interior correlations in polymer chains, a theory of chain self-interaction, and models for scaling, universality, fluctuations of the cluster numbers, and asymptotic decay of cluster numbers. New generalizations of percolation models include continuum percolation, anisotropic percolation and oriented percolation. The experimental studies, utilizing Raman spectroscopy, of the gelation phase transition have addressed a number of systems including the structure of polyacrylamide gel and acrylamide-bisacrylamide copolymers. Author (GRA)

N81-28262# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.

EXAMINATION OF ERRORS IN THE DETERMINATION OF PHASE BOUNDARY THICKNESS BY SMALL ANGLE X-RAY SCATTERING

Ryong-Joon Roe 10 Jun. 1981 39 p refs
(Contract N00014-77-C-0376; NR Proj. 356-655)
(AD-A100418; TR-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

The method of determining the thickness of diffuse phase boundary with density profile governed by equilibrium conditions is proposed. It follows the well known procedure of analyzing the deviations from Porod's law. Errors in the obtained boundary thickness, due to statistical scatter in the intensity data and to the difficulty of separating the effect density fluctuations within the phases, are examined. For this purpose, scattering curves are synthesized on the basis of a well defined model structue with known boundary thicknesses. These synthesized curves, when analyzed according to the proposed method, yield the correct boundary thickness under favorable conditions, but are also shown to lead to very erroneous results in some cases. GRA

N81-28263# Utah Univ., Salt Lake City. Dept. of Chemistry.

STUDIES OF ELASTIC CONSTANTS OF ORIENTED POLY(ETHYLENE TEREPHTHALATE) FILMS USING BRILLOUIN SCATTERING

David B. Cavanaugh and C. H. Wang 21 May 1981 29 p refs
(Contract N00014-79-C-0507)
(AD-A100313; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/9

Brillouin scattering is used to study the elastic behavior of oriented poly(ethylene terephthalate) films. The elastic constants C11, C13, C33 and C44 are determined by measurements of the quasilongitudinal and quasitransverse hypersonic velocities at different angles in the film. The total orientation parameter is calculated for the three draw ratios from the Brillouin hypersonic velocities and are found to be similar to the orientational parameter in the amorphous phase obtained with a different technique. Author (GRA)

N81-28264# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.

OXIDATION OF NON-OXIDE CERAMICS Annual Report, Apr. 1980 - Apr. 1981

T. E. Mitchell, R. M. Cannon, D. M. Mieskowski, N. J. Tighe, and A. H. Heuer 12 Jun. 1981 50 p refs
(Contract F49620-78-C-0053; AF Proj. 2306)
(AD-A101074; AFOSR-81-0530TR) Avail: NTIS HC A03/MF A01 CSCL 11/2

Tracer studies involving CVD single crystals oxidized in oxygen 16 and oxygen 18 were unsuccessful in indicating the direction of diffusing species during oxidation of SiC. A refinement of this technique is planned. Research is also continuing on the characterization of the spherulitic growth which appears during oxidation. The influence on densification of pore curvature, dihedral angle, applied stress and internal pore pressure was undertaken from a theoretical point of view. The results using a simple model indicate that at low dihedral angle (less than 60 degrees) there is an equilibrium porosity in a polycrystalline material; for such a material there is no barrier to nucleation of cavities in dense material. At intermediate dihedral angles, pores with few sides would shrink and disappear, whereas those with many sides would initially shrink but would reach an equilibrium size at which densification would stop. In this case grain growth of the large pores would reduce the number of sides for the pore and promote further densification. For such materials there would be a small barrier to nucleation. Author (GRA)

N81-28265# Bendix Corp., Kansas City, Mo.

PROPERTIES OF POLYSTYRENE BEAD FOAM AS AN ENCAPSULANT FOR ELECTRONIC PACKAGES Final Report

D. J. Fossey Apr. 1981 13 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2618) Avail: NTIS HC A02/MF A01

Polystyrene bead foams (PSBF) was evaluated as an encapsulant for electronic packages. Various properties of PSBF pertinent to the expected environmental conditioning of a prototype electronic package were determined and evaluated for their effects on individual electronic components, within the package. It was determined that PSBF densities of 0.2 to 0.4 4/cu cm provided adequate protection without damaging fragile electronic components. The PSBF densities above 0.4 g/cu cm provide adequate protection from the shock and vibration spectra evaluated, but could damage fragile electronic components during the encapsulation process and thermal cycling. Buildup of electrostatic voltage during encapsulation can be reduced to safe levels by grounding the case of the electronic package. Only the 0.6 g/cu cm PSBF could be made impervious to moisture penetration. DOE

N81-28266# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

CRYSTALLIZATION OF GLASSES IN THE Mg-Si-O-N SYSTEM Ph.D. Thesis

Thomas Carroll Shaw Oct. 1980 137 p refs
(Contract W-7405-eng-48)
(LBL-11759) Avail: NTIS HC A07/MF A01

Crystallization in a glass of composition 59 wt percent NgO and 9 wt percent Si3N4 was investigated in detail using the techniques of differential thermal analysis, X-ray diffraction, optical microscopy, and transmission electron microscopy. Crystallization occurred mainly by internal nucleation of crystals, although some surface crystallization was also observed. Intermediate temperature heat treatments in the temperature range 10000 C to 13000 C crystallized the MgO rich phase of the glass to spherulites of enstatite, but had no effect on the SiO2 rich phase. After heating to temperature above 13000 C, faceted grains of enstatite were formed adjacent to the SiO2 rich pockets by recrystallization of the spherulites. Heating to above 13000 C also precipitated crystals of Si2N2O from residual glass between enstatite grains in the spherulites. DOE

N81-28267# California Univ., Livermore. Lawrence Livermore Lab.

EFFECT OF REINFORCING GRADE SILICON DIOXIDE ON THE PROPERTIES OF A SILICONE ELASTOMER AND ITS CELLULAR SILICONE

W. E. Cady, E. S. Jessop, and A. T. Buckner 24 Nov. 1980 16 p
(Contract W-7405-eng-48)
(UCRL-53104) Avail: NTIS HC A02/MF A01

The addition of reinforcing silicon dioxide to silicone gum has a significant effect on the properties of the elastomer and the cellular silicone cushion made from the elastomer. As the amount of silicon dioxide increases, the hardness, density, and tensile strength of the elastomer increase. Ultimate elongation is less sensitive to the filler content. In the cushion, the stiffness and compression set increase as the filler content increases, but the resiliency of the cushion decreases. DOE

N81-28268# Sandia Labs., Albuquerque, N. Mex.
PHOSPHATE GLASS CERAMICS: FORMATION, PROPERTIES, AND APPLICATIONS
J. A. Wilder, Jr., J. T. Healey, and B. C. Bunker 1981 32 p refs Presented at the 83rd Symp. on Nucleation and Crystallization in Glasses, Washington, D.C., 3 May 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-2613C; CONF-810528-1) Avail: NTIS HC A03/MF A01

Several glasses in the Na2O-CaO-P2O5, Na2O-BaO-P2O5, Na2O-Al2O3-P2O5, and Li2O-BaO-P2O5 systems devitrified to form glass ceramics upon heat treatment. One mol percent of TiO2, ZrO2, Y2O3, La2O3, Ta2O5, as nucleating agents included in a 39 Na2O.10 BaO.50P2O5.1 nucleating agent (mol percent) glass caused a larger volume of crystal phases to form compared to the undoped glass. Grain sizes generally increased with field strength of nucleation cation. DOE

N81-28269# Sandia Labs., Albuquerque, N. Mex.
APPLICATIONS OF SCANNING ELECTRON MICROSCOPY TO FAILURE ANALYSIS IN CERAMICS AND GLASSES
J. J. Mecholsky and J. T. Healey 1981 32 p refs Presented at the Scanning Electron Microscopy Conf., Dallas, 14 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0063C; CONF-810410-2) Avail: NTIS HC A03/MF A01

Scanning electron microscope techniques using secondary and backscattered electron images were applied to the fracture surface analysis of brittle materials. The principles of fracture mechanics and fracture surface analysis were combined to understand fracture of several glasses and ceramics including: optical fibers, solar mirrors, turbine blade, and infrared transmitting dome materials. The scanning electron microscope has capabilities for detecting extremely small fracture origins, defining phase differences, and identifying inhomogeneities and inclusions. A backscatter technique was developed which reveals the microstructures directly from the fracture surface, thereby eliminating the necessity for polishing and etching the surface which destroys fracture surface information. DOE

N81-28270# Sandia Labs., Albuquerque, N. Mex.
HYDROCARBON PLASMA EMISSION AS A MEANS TO MONITOR PLASMA POLYMERIZATION
K. W. Bieg 1981 18 p refs Presented at the Intern. Conf. on Met. Coatings, San Francisco, 6 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0806C; CONF-810425-3) Avail: NTIS HC A02/MF A01

A diagnostic feature of the optical emission from a toluene glow discharge is discussed with respect to the relative intensities of the benzyl radical V spectrum band and the aliphatic CH A(2) delta - X(2) pi band system. The relative intensities of the emissions were evaluated in order to predict the chemical structural characteristics of the deposited polymer film independent of reactor power level, pressure, or flow rate. DOE

N81-28271# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF STRUCTURE-PROPERTY RELATIONSHIPS TO DEVELOP SEVEN SEGMENTED POLYURETHANE ADHESIVES
D. M. Hoffman, H. George Hammon, and LeRoy P. Althouse 1981 22 p refs Presented at the Soc. of Plastics Engr. 39th Ann. Tech. Conf., Boston, 4-7 May 1981
(Contract W-7405-eng-48)
(UCRL-84039; CONF-810506-1) Avail: NTIS HC A02/MF A01

Seven polyurethane adhesives called halthanes were developed to meet a series of design requirements for weapons. Four of the halthanes were made from 4,4 prime methylene bis (phenylisocyanate) terminated prepolymers cured with a blend of polyols; three were made from an prepolymer terminated with hylene W and cured with aromatic diamines. Changes in the structure of prepolymer, curing agent and accelerator were made to achieve initial viscosities in the rage of 6 and 40 Pa-sec, and working times of from 4 to 24 hours. The structure of the polymer/substrate interface was used to obtain adhesive strengths of from 8 to 14 MPa at room temperature. The morphology and concentration of the hard and soft segments were used to control the modulus and elasticity of these segmented polyurethanes. Seven polyurethane adhesives were developed that bond rapidly and well, have low to intermediate modulus over a wide temperature range, and appear to be reasonably compatible with other components. DOE

N81-28272# Bendix Corp., Kansas City, Mo.
LASER MACHINING OF CERAMIC
Arthur Laudel 1980 10 p Presented at the Electro-Optics/Laser Conf., Boston, 19 Nov. 1980
(Contract DE-AC04-76DP-00613)
(BDX-613-2507; CONF-801139-2) Avail: NTIS HC A02/MF A01

Laser machining was used to contour the ceramic substrates and to drill holes in the ceramic for frontside backside interconnections (vias) and holes for mounting components. A 1000 W CO2 type laser was used. The laser machining process, and methods used for removing protruding debris and debris from holes, for cleaning the machined surfaces, and for refiring are described. The laser machining process described consistently produces vias, component holes and contours with acceptable surface quality, hole locations, diameter, flatness and metallization adhesion. There are no cracks indicated by dipping in fluorescent dye penetrant and the substances are resistant to repeated thermal shock. DOE

N81-28273# Duke Univ., Durham, N. C. Chemical Labs.
XAD-2 THERMAL BLANK DETERMINATION Final Report, May 1978 - Jun. 1979
C. H. Lochmueller and Eric C. Jensen Mar. 1981 31 p refs (Grant EPA-R-805494)
(PB81-172264; EPA-600/2-81-047; IERL-RTP-1091A) Avail: NTIS HC A03/MF A01 CSCL 07D

A polystyrene-divinylbenzene porous polymer is used in an adsorbent trap for the collection of volatile organic species in order to examine the stability of XAD-2 resin, particularly its thermal stability, under simulated use conditions. While the bulk thermal stability of the resin may be good, introduction of contaminants on the milligram scale can be sufficient to give a large blank value in relation to the total collected material. The magnitude of the thermally induced blank was assessed primarily by measurement of the total chromatographable organic fraction of the resin extract. In addition, a gas chromatography/mass spectroscopy study was presented to identify the components of the blank. GRA

N81-28147# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
DEFINITION AND DESCRIPTION OF ENGINEERING PLASTICS BUSINESS Final Report
Glen A. Thommes *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 8-11
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28148# General Motors Research Labs., Warren, Mich. Polymers Dept.
TRANSPORTATION AND ENGINEERING PLASTICS Final Report
Philip Weiss *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 13-15 refs
(For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28149# Bell Telephone Labs., Inc., Murray Hill, N. J.
GRAMS TO TONS (PLASTICS IN COMMUNICATIONS)
L. D. Loan *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 16-17 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28150# Akron Univ., Ohio. Inst. of Polymer Science.
THE FUTURE OF ENGINEERING PLASTICS Final Report
F. N. Kelley *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 21-26 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28151# ITT Rayonier, Inc., Stamford, Conn.
NEW HORIZONS FOR CELLULOSICS
H. L. Hergert *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 27-31 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28152# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.
MODIFICATION OF FIBERS BY RADIATION GRAFTING Final Report
Vivian T. Stannett *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 32-34 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28153# Monsanto Textiles Co., Pensacola, Fla.
FORTY YEARS OF MELT SPINNING Final Report
F. S. Riordan, Jr. and J. H. Saunders (Monsanto Textiles Co., Pensacola, Fla.) *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 35-43 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28154# Allied Chemical Corp., Morristown, N.J.
RECENT DEVELOPMENTS IN THE OPTIMIZATION OF A MELT SPINNING PROCESS Final Report
Dusan C. Preevorsek and Young D. Kwon *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 44-52 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28156# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
EXTENDED CHAIN AROMATIC POLYMERS Final Report
J. A. Fitzgerald *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 58-67 refs (For primary document see N81-28146 19-24)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28157# Monsanto Textiles Co., Pensacola, Fla.
POLYAMIDE-HYDRAZIDE AND COPOLYHYDRAZIDE FIBERS Final Report
W. Bruce Black *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 70-77 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28158# Celanese Research Co., Summit, N.J.
FIBERS FROM ANISOTROPIC MELTS Final Report
D. R. Wilson and R. S. Jones *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 78-85 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28159# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
PROCESSING OF HIGH STRENGTH, HIGH TEMPERATURE POLYMERS Final Report
Thaddeus E. Helminiak *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 86-87 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28165# Environmental Protection Agency, Washington, D.C.
TSCA AND THE PAINT AND COATINGS INDUSTRY Final Report
Douglas G. Bannerman *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 148-151 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28166# Du Pont de Nemours (E. I.) and Co., Philadelphia, Pa.
COATINGS FROM ACRYLIC POLYMERS Final Report
Werner S. Zimmt *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 152-155 (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28167# Union Carbide Corp., South Charleston, W.Va.
ADVANCES IN LATEX TECHNOLOGY Final Report
D. R. Bassett and K. L. Hoy *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 156-161 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28168# American Cyanamid Co., Stamford, Conn.
CROSS-LINKING AGENTS FOR WATER-BORNE AND HIGH SOLIDS COATINGS Final Report
Werner J. Blank *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 162-166 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28169# Rohm and Haas Co., Spring House, Pa.
RECENT DEVELOPMENTS IN OXIDATIVE POLYMERIZATION Final Report
W. D. Emmons *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 167-172 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28170# Naval Research Lab., Washington, D. C.
FLUORINATED POLYMERS AND THEIR APPLICATIONS Final Report
James R. Griffith *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 173-174 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

N81-28171# Battelle Memorial Inst., Columbus, Ohio.
RADIATION CURABLE COATINGS Final Report
V. D. McGinniss *In* American Chemical Society The 16th Natl. Symp. on Polymers in the Serv. of Man 1980 p 175-180 refs (For primary document see N81-28146 19-23)
Avail: NTIS HC A09/MF A01 CSCL 07/3

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N81-28274 California Univ., Berkeley.
LOW TEMPERATURE COAL LIQUEFACTION BY ZINC CHLORIDE AND TETRALIN Ph.D. Thesis
Frank Hershkowitz 1980 158 p
Avail: Univ. Microfilms Order No. 8113063

High conversions of subbituminous coal to liquid or soluble products were obtained by treatment with large amounts of zinc chloride together with tetralin at temperatures below those of coal pyrolysis. Treatments were carried out in a stirred batch reactor at 250 to 325 C for durations of 10 to 120 min with hydrogen at 3.5 MPa total pressure. The extent of conversion was determined by solvent extractions with cyclohexane, toluene, and pyridine, and products were characterized by elemental analysis, gel permeation chromatography, proton nuclear magnetic

resonance, and oxygen functional group analysis. The conversions to soluble products reached 50% solubility in cyclohexane and 85% in pyridine for treatment at 300 C. This conversion increased with increasing temperature and duration of treatment, and was accompanied by progressive reductions in molecular weight as well as by elimination of oxygen (especially ether oxygen) in coal. This behavior, along with the increase in product aromaticity with increasing conversion, indicates a mechanism involving ZnCl2-catalyzed cleavage of crosslinking bonds in the coal.
Dissert. Abstr.

N81-28275*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COAL PUMP DEVELOPMENT PHASE 3 Final Report, Oct. 1979 - Jun. 1980
Raymond O. Kushida, Vega D. Sankur, Fred G. Gerbracht, and Vinayak Mahajan Jul. 1980 128 p refs
(Contracts NAS7-100; DE-AI21-77ET-13032; JPL Proj. 5030-479)
(NASA-CR-164647; JPL-PUB-81-13; DOE/ET-13032/1) Avail: NTIS HC A07/MF A01 CSCL 21D

Techniques for achieving continuous coal sprays were studied. Coaxial injection with gas and pressure atomization were studied. Coal particles, upon cooling, were found to be porous and fragile. Reactivity tests on the extruded coal showed overall conversion to gases and liquids unchanged from that of the raw coal. The potentials for applications of the coal pump to eight coal conversion processes were examined. A.R.H.

N81-28276# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
BEHAVIOR OF FUELS AT LOW TEMPERATURES Interim Report
E. A. Frame Sep. 1980 29 p refs
(Contract DAAK70-80-C-0001)
(AD-A100332; AFLRL-138) Avail: NTIS HC A03/MF A01 CSCL 21/4

In developing the filter/separator component of the Arctic Fuel Dispensing Equipment, MERADCOM is considering two options: (1) development of a completely new filter/separator or (2) modification of the current Military Standard filter/separator for use at low temperatures. This report contains test data on the low-temperature behavior of five test fuels - JP-4, JP-5, JP-8, DF-A, and DF-1 as well as two additional test fuels made by adding icing inhibitor (ethylene glycol monomethyl ether) to the DF-A and DF-1. Four additional fuels were obtained from Alaska (JP-4, Jet A-1, DF-A, and JP-5) and low temperature behavior of these field samples was determine. This report contains (1) a brief summary of industry practice in handling fuels at low temperatures, (2) inspection properties of test fuels, (3) viscosities and conductivities of fuels at low temperatures, (4) fuel contaminant behavior at low temperatures, and (5) fuel system icing inhibitor effects at low temperatures. Author (GRA)

N81-28277# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
FUEL MICROEMULSIONS FOR JET ENGINE SMOKE REDUCTION Final Report, 4 Jul. 1979 - 15 Mar. 1980
D. W. Naegeli, G. E. Fodor, and C. A. Moses Tyndall AFB, Florida Air Force Engineering and Services Center May 1980 52 p refs
(Contract F08635-79-C-0213)
(AD-A100489; SWRI-MED118; AFESC/ESL-TR-80-25) Avail: NTIS HC A04/MF A01 CSCL 21/4

Several ethanol/fuel, methanol/fuel and water/fuel microemulsions were prepared with JP-4 and JP-8 base fuels and the appropriate surfactants. Both metallic (ferrocene) and nonmetallic (hydrazine) smoke reducing additives were examined for possible synergistic effects when combined with the microemulsified fuels. The fuels were tested at the takeoff, climb, cruise and ground idle operating condition, and the exhaust smoke, flame radiation and gaseous emissions were measured. The exhaust smoke and flame radiation were significantly reduced by the additions of alcohols and water to the base fuels. Ethanol was found to be most cost effective because it required the least amount of surfactant, which was the most expensive fuel component. The tendency of the microemulsions to form soot was found to correlate with H/C ratio in the same way as typical petroleum-base fuels. Ferrocene, which is well known for its ability to reduce exhaust smoke, had the same effect on the microemulsions as the base fuels; it did not affect flame radiation. Hydrazine was not an effective additive for reducing exhaust smoke. Author (GRA)

N81-28278# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Analysis Lab.
PROPELLANT SURVEILLANCE REPORT, LGM-30F AND G STAGE 1. PHASE G, SERIES 1 (TP-H1011)
John A. Thompson May 1981 124 p
(AD-A100361; MANPA-458(81)) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRBM Project M04046C-WNL01529. The data from this test period are combined with data from previous testing and entered into the G085 Computer for storage, analysis, and regression analysis. From the statistical analysis of all data tested to date (fifteen years for F G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 System. Author (GRA)

N81-28279# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
A SURFACE DAMAGE INVESTIGATION ON UNIAXIAL TENSILE SPECIMENS PREPARED BY COMMON CUTTING METHODS Special Report, 15 Jan. 1979 - 15 Jun. 1980
Thomas J. C. Chew and Dale A. Wells Edwards AFB, Calif. AFRPL Feb. 1981 42 p refs
(AF Proj. 5730)
(AD-A100517; AFRPL-TR-80-66) Avail: NTIS HC A03/MF A01 CSCL 19/1

An experimental investigation was conducted to evaluate propellant test specimen surface damage caused by three common cutting methods, each operated at three different speeds. The three methods were guillotine cutting, sawing and milling. For each set of cutting conditions (method and speed), six specimens were obtained. Three of these specimens were subjected to surface damage evaluation using a scanning electron microscope. The remaining three specimens were subjected to uniaxial tensile testing. The effects of each set of cutting conditions on specimen surface damage and the resulting mechanical property change were analyzed. It was found that saw-cut and mill-cut propellant surfaces were similar in appearance and relatively smooth, whereas guillotine-cut surfaces were more rugged and had sustained more damage as manifested in extracted, dislocated and fractured particles. However, no significant difference in uniaxial tensile properties was found between the three cutting methods or between the three cutting speeds in each cutting method. It is believed that the absence of bonding agent in the test propellant (TP-H1011) is a significant factor in the insensitivity of test specimens mechanical properties to their surface damage condition. Author (GRA)

N81-28280# Vulcan-Cincinnati, Inc., Ohio.
FEASIBILITY STUDY OF FUEL GRADE ETHANOL PLANT FOR ALCOHOL FUELS OF MISSISSIPPI, INC., VICKSBURG, MISSISSIPPI, VOLUME 1
Jan. 1981 181 p 3 Vol.
(Contract DE-FG01-80RA-50349)
(DOE/RA-50349/T1-Vol-1) Avail: NTIS HC A09/MF A01

The results are presented of a feasibility study performed to determine the technical and economic viability of constructing a alcohol plant utilizing the N.Y.U. continuous acid hydrolysis process to convert wood wastes to fuel grade alcohol. The proposed site in the Vicksburg Industrial Foundation Corporation Industrial Park is adequate from all standpoints, for all plant capacities envisioned. Local hardwood sawmills provide adequate feedstock for the facility. Sale of fuel ethanol would be made primarily

through local distributors and an adequate market exists for the plant output. With minor modifications to the preparation facilities, other waste cellulose materials can also be utilized. There are not anticipated major environmental, health, safety or socioeconomic risks related to the construction and operation of the proposed facility. The discounted cash flow and rate of return analysis indicated that the smallest capacity unit which should be built is the 16 million gallon per year plant, utilizing cogeneration. DOE

N81-28281# Vulcan-Cincinnati, Inc., Ohio.
FEASIBILITY STUDY OF FUEL GRADE ETHANOL PLANT FOR ALCOHOL FUELS OF MISSISSIPPI, INC., VICKSBURG, MISSISSIPPI. VOLUME 2: ENVIRONMENTAL, HEALTH, SAFETY AND SOCIOECONOMIC (EHSS) INFORMATION
Jan. 1981 45 p 3 Vol.
(Contract DE-FG01-80RA-50349)
(DOE/RA-50349/T1-Vol-2) Avail: NTIS HC A03/MF A01

The environmental, health, safety, and socioeconomic impacts from the construction and operation of the proposed ethanol production facility are addressed. It is concluded that the overall impact in these areas would be positive. The availability of domestically derived motor fuel would increase and the economy would be improved due to increased jobs and income in the region. Particulate emissions would be within allowable air pollution requirements. A description of the site and the plant/process is also given. J.M.S.

N81-28282# Vulcan-Cincinnati, Inc., Ohio.
FEASIBILITY STUDY OF FUEL GRADE ETHANOL PLANT FOR ALCOHOL FUELS OF MISSISSIPPI, INC., VICKSBURG, MISSISSIPPI, VOLUME 3
Oct. 1981 183 p 3 Vol.
(Contract DE-FG01-80RA-50349)
(DOE/RA-50349/T1-Vol-3) Avail: NTIS HC A09/MF A01

The technical and economic viability of constructing an alcohol plant utilizing the N.Y.U. continuous acid hydrolysis process to convert wood wastes to fuel grade alcohol was investigated. Block process flow diagrams, process flow diagrams, a site vicinity map, and a plant location map are presented. J.M.S.

N81-28283# Gulf Research and Development Co., Pittsburgh, Pa.
METHYL ARYL ETHERS FROM COAL LIQUIDS AS GASOLINE EXTENDERS AND OCTANE IMPROVERS
G. M. Singerman Nov. 1980 35 p refs
(Contract DE-AC01-79CS-50022)
(DOE/CE-50022/1) Avail: NTIS HC A03/MF A01

A mixture of methyl aryl ethers derived from the phenols present in direct liquefaction coal liquids shows considerable promise as a gasoline blending agent and octane improver. The mixture of methyl aryl ethers was blended at five volume percent with a commercial unleaded gasoline. The properties and performance of the blend in a variety of laboratory and automobile tests is reported. The tests show that the mixture of methyl aryl ethers improves gasoline octane without degrading other gasoline properties. DOE

N81-28284# California Univ., Livermore. Lawrence Livermore Lab.
COAL GASIFICATION
Mar. 1981 28 p refs Transl. into ENGLISH from Congr. on the Uses of Coal in the Iron and Steel Ind., Mexico City, Jul. 1976; sponsored by ILAFA
(Contract W-7405-eng-48)
(UCRL-Trans-11686) Avail: NTIS HC A03/MF A01

The theoretical basis for gasification of coals and the various processes for the production of gases from coal, whether having high or low heating value are discussed. The latest methods were developed with a view to the three uses of coal: as a source of energy, as a raw material for the iron and steel is concluded that the process should be of interest as a means of making better use of the coal from southern Brazil. DOE

N81-28285# Pennsylvania Univ., Philadelphia.
THERMOCHEMICAL PROCESSES FOR HYDROGEN PRODUCTION BY WATER DECOMPOSITION Final Report
D. D. Perlmutter Aug. 1980 10 p refs
(Contract DE-AS02-76ER-02747)
(DOE/ER-02747/T1) Avail: NTIS HC A02/MF A01

Models were derived for simulating the heat and mass transfer processes inside the reactor and tested by experiments. The effects of surface renewal of solids on the mass transfer phenomena were studied and related to the solid mixing. Catalysis by selected additives were studied experimentally. The separate results were combined in a simulation study of industrial scale rotary reactor performance. A study was made of the controlled decompositions of a series of inorganic sulfates and their common hydrates, carried out in a thermogravimetric analyzer, a differential scanning calorimeter, and a differential thermal analyzer. Various sample sizes, heating rates, and ambient atmospheres were used to demonstrate their influence on the results. The purposes of this study were to: (1) reveal intermediate compounds, (2) determine the stable temperature range of each compound, and (3) measure reaction kinetics, in addition, were demonstrated to have catalytic effects to varying degrees for the different salts. DOE

N81-28286# Oak Ridge National Lab., Tenn. Chemical Technology Div.
PHOTOSYNTHETIC WATER SPLITTING
Elias Greenbaum 1981 16 p refs Presented at the 1st SERI Solar Hydrogen Production Contractors' Rev. Meeting, Washington, D.C., 26-27 Mar. 1981 Prepared for the Midwest Research Inst., Golden, Colo. and the Gas Research Inst., Chicago
(Contract W-7405-eng-26)
(CONF-810345-1) Avail: NTIS HC A02/MF A01

The photosynthetic unit of hydrogen evolution, the turnover time of photosynthetic hydrogen production, and hydrogenic photosynthesis are discussed. Results are given on simultaneous photoproduction of hydrogen and oxygen, kinetic studies, microscopic marine algae-seaweeds, and oxygen profiles. DOE

N81-28287# Brookhaven National Lab., Upton, N. Y.
HYDROGEN PRODUCTION FROM SMALL HYDROPOWER SITES Final Report
Apr. 1980 83 p
(Contract DE-AC02-76CH-00016)
(BNL-51309) Avail: NTIS HC A05/MF A01

A synergistic relationship was not found to exist between low head hydropower and electrolytic hydrogen production. The storageability of hydrogen was expected to mitigate problems of hydrogen generation variability associated with the use of low head hydropower as the power source. The expense of gaseous hydrogen storage equipment effectively eliminates storage as a means to decouple hydrogen demand and power/hydrogen production. From the opposite perspective, the availability of a low and stable cost of power from low head hydro was expected to improve the competitiveness of electrolysis; In actuality, the results indicated that hydroelectric power from small dams would be comparatively expensive by current grid power standards (mid 1979). Electrolysis, in the capacity range considered here, is less sensitive to the cost of the power than originally presumed. Other costs including depreciation and capital related charges are more significant. DOE

N81-28288# Ad-Ex International, Portola Valley, Calif.
INITIATION OF EXPLOSIVES: A MULTI-LAYERED PROBLEM IN DETONATION PHYSICS
M. Held May 1980 57 p refs Transl. into ENGLISH from Explosivstoffe (East Germany), v. 16, no. 5, May 1980 p 97-113 Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11661) Avail: NTIS HC A04/MF A01

The physical and chemical aspects of the process by which chemical high energy explosives are detonated are discussed. Information is included on the initiation of chemical reactions, shock wave motion, changes in energy level within the explosive, excitation mechanisms, and pressure build up initiation with a shaped charge jet, shaped detonators, and fuse cords. DOE

N81-28289# Pittsburg Univ., Pa. Dept. of Civil Engineering.
BIO-OXIDATION OF THIOCYANATES TYPICAL OF COAL CONVERSION EFFLUENTS Final Report
R. D. Neufeld, Lorraine Mattson, and Patricia Lubon 8 Jan. 1981 142 p refs

(Contract DE-AS02-77EV-04502)
(DOE/ET-04502/7; SETEC-CE-81-001) Avail: NTIS HC A07/MF A01

Data for the biological degradation fate kinetics of thiocyamate removal were developed as well as material balance information for the fate of sulfur and nitrogen resulting from such biodecomposition of aqueous thiocyanates. A literature review of thiocyanate biodegradation was conducted which indicates that while much biochemistry information is available, little information in the biological processing arena is known. Based on both batch and continuous culture experiments utilizing an activated sludge type of system with strictly thiocyanate degradating organisms, the specific utilization rate for SCN degradation was found to follow a substrate inhibition biokinetic relationship. The observed biomass sludge production rate was quantified, as a function of sludge age in the bioreactor. The major metabolic by products of SCN aerobic biodegradation are ammonia and sulfate, with such formation being stochiometric with SCN. DOE

N81-28290# R and D Associates, Marina Del Rey, Calif.
RECOMMENDED RESEARCH ON LNG SAFETY Final Report, 1 Mar. 1979 - 31 Dec. 1980
H. J. Carpenter and F. R. Gilmore Mar. 1981 304 p refs
(Contract DE-AC03-79EV-10024)
(DOE/EV-10024/1; RDA-TR-111000-001) Avail: NTIS HC A14/MF A01

Although the modern liquefied natural gas (LNG) industry has enjoyed excellent success in providing for safe operations, significant questions remain on the part of many, the expressions of which were intensified with the addition of marine-based LNG import terminals. Public safety with regard to large scale importation of this fuel has received widespread attention in the U.S. Congress, state legislatures, county and city governments, and from various individuals and public groups, with coverage in all the news media, including books published on the subject. The safety concerns have centered around the consequences to the public of a large spill of the cryogenic liquid from an ocean tanker or a larger storage tank, either of which might hold as much as 125,000 cu m of LNG. DOE

N81-28291# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ECONOMIC EVALUATION OF COAL GASIFICATION FOR ELECTRIC POWER GENERATION (AN UPDATE) Final Report
R. Beckman, W. Hsu, and J. Joiner Feb. 1981 188 p refs Sponsored by EPRI
(EPRI Proj. 239-2)
(EPRI-AP-1725) Avail: NTIS HC A09/MF A01

This is an economic update of previous evaluations of various coal gasification and power generation systems. Capital and operating costs of all the systems were escalated to mid 1978 dollars from their original mid 1976 basis. The processes studied included the Lurgi dry ash gasifier; the British Gas Corporation's Slagger; the Texaco entrained system; Combustion Engineering's two stage entrained atmospheric pressure gasifier; Foster-Wheeler's two stage entrained pressurized system; and the Tosco/HRI Tosco-Dyne process. For comparative purposes, a coal fired steam electric generating station with stack gas desulfurization in subcritical and supercritical designs is also developd. The plant sizes used in all of the screening studies are in the capacity range of 1000 MW to 1200 MW. These plants feed a constant coal rate equivalent to 10,000 tons/day of Illinois No. 6 coal. Results indicate that the installed plant costs have escalated by elevent to 19 percent from mid 1976 plant investment costs. DOE

N81-28292# TRW Energy Systems Group, Morgantown, W. Va.
ECONOMIC ANALYSIS OF VERTICAL WELLS FOR COAL-BED METHANE RECOVERY
Arnold Snygg and William Fox Apr. 1981 62 p refs
(Contract DE-AC21-78MC-08089)
(DOE/MC-08089/107) Avail: NTIS HC A04/MF A01

Previous economic studies of the recovery and utilization of methane from coalbeds using vertical wells were based on drainage in advance of mining where a single seam is drained with well spacing designed for rapid predrainage. This study extends the earlier work and shows that methane recovery costs can be reduced significantly by increasing well spacing and draining multiple coalbeds. A favorable return on investment can be realized in many geologic settings using this method. Sensitivity of recovery economics to certain development costs and parametric variations are also examined as are the economics of three methane utilization options. DOE

N81-28293# Los Alamos Scientific Lab., N. Mex.
FLASH PYROLYSIS OF COAL THROUGH SOLAR HEATING
W. H. Beattie 1981 22 p refs Presented at the AS/ISES Ann. Conf., Philadelphia, 26-30 May, 1981 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-81-764; CONF-810509-4) Avail: NTIS HC A02/MF A01

A laboratory technique for studying flash pyrolysis by radiantly heating small stationary samples of powdered coal with the beam of a carbon dioxide laser is described. With this technique flux levels equivalent to those available from solar furnaces are attainable, experimental parameters are easily controllable, and experimental turn around time is short. The pyrolysis of a western subbituminous coal was studied with laser and solar heating. The pyrolysis products were a gas composed principally H2, CH4, CO, and CO2, tar, and char. Under laser heating, the gas yield increased with flux up to W/sq cm. Under conditions of complete pyrolysis, tar and gas yields were inversely proportional to each other and char yield was almost constant. Solar coal pyrolysis experiments at the White Sands Solar Furnace gave results in general agreement with the laser pyrolysis experiments, except that gas yields were higher. DOE

N81-28294# Oak Ridge National Lab., Tenn. Fossil Energy Program.
TECHNICAL AND ECONOMIC EVALUATION OF SELECTED COAL-LIQUEFACTION PROCESSES. PRELIMINARY SCREENING EVALUATION
R. Salmon, R. C. Forrester, III, S. P. N. Singh, J. F. Fisher, R. M. Wham, S. W. Thiel, and J. P. Meyer Apr. 1981 197 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7581) Avail: NTIS HC A09/MF A01

Preliminary scoping evaluations of ten conceptual coal liquefaction processes were made for the Department of Energy using available published information. Production costs calculated under a consistent set of economic criteria varied from $0.78 to $1.47/gal for gasoline in constant 1979 dollars. However, existing design documents showed little consistency as to status of process development, credibility of process design basis, completeness of design, or conservatism of cost estimation. It is concluded that a more complete and thorough design study of each process is necessary to achieve any degree of technical and economic consistency, and that it is therefore not possible to satisfy DOE's desire for consistent technical and economic comparisons in this type of preliminary scoping study. DOE

N81-28295# Sandia Labs., Albuquerque, N. Mex.
ROLE OF SITE CHARACTERISTICS IN THE CONTROL OF UNDERGROUND COAL GASIFICATION
B. E. Bader and R. E. Glass Mar. 1981 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2664) Avail: NTIS HC A03/MF A01

Underground coal gasification (UCG) offers many potential economic and environmental advantages. Offsetting these advantages is the substantial lack of ability to control the UCG process. For example, only three elements of external process control were utilized. These are: (1) injected gas compositions; (2) injected gas flow rate; and (3) product gas pressure. Variation of these independent variables in UCG tests resulted in mixed indications of their effectiveness. Other possible elements of control are indicated based on the results of recent field tests and modeling efforts. These elements are associated with the selection of the specific site where the process is conducted and with the design of the test itself. The results of previous UCG field tests indicated that the conditions that exist in the coal seam and overburden before the start of the combustion process may dominate all other factors. These conditions are

the geochemical characteristics, such as faulting and groundwater hydrology, as well as the details of the test layout, well completions, and linking method. DOE

N81-28296# Booz-Allen and Hamilton, Inc., Palo Alto, Calif.
ASSESSMENT OF INTERNATIONAL TAR SANDS RECOVERY AND UPGRADING PROCESSES
Dec. 1980 373 p refs Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15323) Avail: NTIS HC A16/MF A01

Foreign technologies that might aid in the future development of heavy oil deposits in the United States are analyzed. This information on foreign technology developments would aid in formulating and directing policy decisions on future research programs within the United States. Emphasis of the study is on post-1978 developing technologies. The scope includes sizing the resource base and reviewing and evaluating past, present, and planned research and field developments on processes for mining, producing, extracting, and upgrading very heavy oils recovered from tar sands. The characteristics and location of the world's principal tar sands resources are presented. Production methods, both above ground and in-situ, factors inherent in choosing between methods, and the commercial and pilot application of those methods are discussed. The factors are presented which affect the process selection for upgrading bitumen and very heavy oils so they can be piplined and/or refined to a desired mix of consumer products. DOE

N81-28297# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DESIGN REPORT: SMALL-SCALE FUEL ALCOHOL PLANT
1980 130 p
(Contract DE-AC07-76ID-01570)
(IDO-10088-Vol-1) Avail: NTIS HC A07/MF A01

The objectives of the report are to provide potential alcohol producers with a reference design and provide a complete, demonstrated design of a small scale fuel alcohol plant. This report describes a small scale fuel alcohol plat designed and constructed for the DOE by EG and G Idaho, Inc., an operating contractor at the Idaho National Engineering Laboratory. The plant is reasonably complete, having the capability for feedstock preparation, cooking, saccharification, fermentation, distillation, by product dewatering, and process steam generation. An interesting feature is an instrumentation and control system designed to allow the plant o run 24 hours per day with only four hours of operator attention. Where possible, this document follows the design requirements established in the DOE publication Fuel From Farms, which was publishd by February 1980. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-28298 California Univ., Berkeley.
HYBRID MODELLING OF SOIL-STRUCTURE INTERACTION Ph.D. Thesis
Sunil Gupta 1980 104 p
Avail: Univ. Microfilms Order No. 8113052

A hybrid model for the analysis of three-dimensional soil-structure interaction is proposed. The modelling is achieved by partitioning the total soil-structure system into a near field and far field with a hemispherical interface. The near field, which consists of the structure to be analyzed and a finite region of soil around it is modelled by the finite element method. The semi-infinite far field impedance matrix correspondng to the interface degrees of freedom is developed, accounting for the loss of energy due to waves travelling away from the foundation. The far field impedance matrix for torsional vibrations is determined analytically. A semi analytical approach is adopted for general loading and the far field modeled through continuous impedance functions placed in the three coordinate directions at the interface. The resulting hybrid model reproduces the known compliances of a rigid circular plate on an elastic halfspace. Numerical results for the analysis of soil-structure interaction in surface or embedded structures are presented. Dissert. Abstr.

N81-28299 Iowa Univ., Iowa City.
ENDOCHRONIC THEORY FOR THE MECHANICAL BEHAVIOR OF COHESIONLESS SOIL UNDER STATIC LOADING Ph.D. Thesis
Tzuupo Wang 1980 177 p
Avail: Univ. Microfilms Order No. 8114312

The constitutive equation for cohesionless soil is developed within the framework of the endochronic of plasticity. Based on the Gibbs formulation, the present form of the endochronic theory is derived. It is found that three groups of internal state variables should be employed to describe the complex behavior of soil. To each group of internal variables there corresponds an evolution equation for the variables and an endochronic time. The theory is shown to predict essential features of the mechanical behavior of cohesionless soil under static loading condition. These include: (1) the nonlinear volumetric response at isotropic consolidation; (2) densification and dilation due to the change in hydrostatic and deviatoric state; (3) the deviatoric response and its dependence on normal stress; (4) the effects of unloading and reloading during isotropic consolidation, shearing, densification and dilation; and (5) the pore pressure built up for undrained sand. Dissert. Abstr.

N81-28300*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLASHBACK FLAME ARRESTER DEVICES FOR FUEL CARGO TANK VAPOR VENTS Final Report
R. A. Bjorklund and Raymond O. Kushida Mar. 1981 126 p refs Sponsored by NASA
(NASA-CR-164644; JPL-81-10; CG-D-20-81) Avail: NTIS HC A07/MF A01 CSCL 13L

The flame quenching capability of four types of flame arresting devices suitable for installation on fuel cargo tank vents of marine transport vessels is evaluated. A single 30 mesh screen, a dual 20 mesh screen, a spiral wound crimped metal ribbon, and a packed bed of ballast rings were tested. Flame speed and flame penetration of the test arresters were determined. Eight fuels representative of bulk cargoes were tested. The test arresters quenched a minimum of three flashback flames from all eight fuels, with one exception: high speed ethylene flames penetrated the dual 20 mesh screen on three tests. The arresters withstood the sustained flame from a propane/air mixture for 30 minutes. None of the arresters withstood the sustained flame from an ethylene/air mixture for more than 7 minutes.
J.D.H.

N81-28301# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
FIELD TEST SECTIONS ON EXPANSIVE SOIL Final Report, Oct. 1968 - Aug. 1980
Lawrence D. Johnson May 1981 91 p refs
(AD-A100474; WES/TR/GL-81-4) Avail: NTIS HC A05/MF A01 CSCL 08/13

This report presents results of field observations at three test sections consisting of 100-ft-square moisture barriers over the surface of in situ swelling soils located near Clinton, Miss.; Lackland Air Force Base, Tex.; and Fort Carson, Colo. Results from more than five years of observations show that long-term or progressive heave builds up over many years and tends to be erratic, with most progressive heave accumulating toward the center of the sections. Seasonal or short-term cyclic heave was substantial in the semiarid climate of Lackland and was most noticeable with 10 ft inside and outside of the edge of the 100-ft-square sections. The cyclic seasonal heave exceeded the long-term progressive heave at Lackland. Seasonal heave was not significant at the Clinton test section where a nonswelling overburden overlaid the swelling soil. The amount of heave was strongly influenced by the depth to the water table. The equilibrium pore water pressure profiles obtained for soils taken from beneath the test sections are consistent with pressures between saturated (zero pore water pressure) and negative hydrostatic above the original groundwater level. The large magnitude of the osmotic component of suction observed at the Fort Carson test section had little effect on heave, even after 7 years of observations.
GRA

N81-28302# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
PHYSICAL PROPERTIES OF A LIGHTWEIGHT CONCRETE FOR OTEC COLD WATER PIPES
J. S. OConnor Mar. 1981 90 p ref Prepared in cooperation with Construction Technology Labs. Skokie, Ill.
(Contract DE-AI01-77ET-20342)
(JHU/APL-SR-80-5B) Avail: NTIS HC A05/MF A01

Results of tests to determine compressive, tensile, and flexural strengths as well as elastic and long term deformation characteristics of the selected lightweight concretes are presented. In addition, tests were made to determine long time absorption characteristics at hydrostatic pressures of 0, 700, and 1400 psi. All long term tests were continued for a period of at least one year. Tests were also made to determine compressive, tensile, and fatigue strengths under conditions simulating those that could occur in service. These tests were conducted at hydrostatic pressures of 0, 700, and 1400 psi. DOE

N81-28303# Argonne National Lab., Ill. Energy and Environmental Systems Div.
IMPLEMENTATION PLANNING FOR INDUSTRIAL ENERGY CONVERSATION: APPROACH AND METHODOLOGY
T. G. Alston, G. Falk, P. J. Grogan, D. Katz, and J. Tatar Jan. 1981 46 p refs
(Contract W-7405-eng-38)
(ANL/CNSV-TM-55) Avail: NTIS HC A03/MF A01

Details of an industry-specific Conservation Technology Implementation Branch implemenation plan is described in detail. CTIB has conducted implementation planning in the steel, pulp/paper, and agriculture/food processing industries, but in FY 1981, CTIB plans to conduct planning for the chemicals, petroleum refining, aluminum, glass, cement, and textile industries. Guidelines are presented for each contractor for each industry toward a common methodology in terms of approach, areas of analysis, assumptions, and reporting. The major parts of the CTIB plan are: an implementation study consisting of technology selection, market demand analysis, and policy analysis, and a plan consisting of a detailed description and schedule of future CTIB actions, followed by a recommended system for monitoring market results when the plan is implemented. DOE

N81-28304# Cornell Univ., Ithaca, N. Y.
COMPUTER-AIDED INJECTION MOLDING SYSTEM Progress Report, 1 Sep. 1979 - 30 Sep. 1980
K. K. Wang, S. F. Shen, C. Cohen, C. A. Hieber, A. I. Isayev, I. Akiyama, P. Khullar, R. K. Uphadhyav, K. Y. Wang, and S. Jain Oct. 1980 272 p refs
(Grant NSF DAR-78-18868)
(PB81-174088; NSF/RA-800418; PR-7) Avail: NTIS HC A12/MF A01 CSCL 13H

Advances are reported in the development of the scientific bas for the injection molding of polymeric materials aimed at an integrated computer program for mold design and manufacture as well as for simulation and prediction of optimum process control. Progress is described in extending the simulation program to the filling of cavities of arbitrary cross section for fluids having a yield stress which will be applicable to the injection molding of filled polymeric materials. GRA

N81-28305# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
COMPUTER-AIDED DESIGN SYSTEM FOR CASTINGS Progress Report
J. T. Berry Oct. 1980 131 p refs
(Grant NSF DAR-78-24301)
(PB81-172769; NSF/RA-800436; PR-1) Avail: NTIS HC A07/MF A01 CSCL 13H

A large scale investigation on the problems associated with the computer-aided design of castings is conducted. Six task areas were selected for investigation, which relate to major scientific or engineering roadblocks. These roadblocks pertain to geometric modeling/physical simulation problems, the provision of thermal transport data, the problem of filling transients associated with pouring of castings, the modeling of interfacial phenomena, the accurate description of the interaction of the molding-medium and the solidifying casting, and the total economics of the computation system itself. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N81-28306 Purdue Univ., Lafayette, Ind.
SIGNALS AND PROCESSING FOR RANDOM SIGNAL RADARS Ph.D. Thesis
George Stennis Moore 1980 215 p
Avail: Univ. Microfilms Order No. 8113730

Signals and associated processing techniques are developed which improve the performance, simplify the implementation, and are more amenable to adaptive operation for radars using the random signal concept. These goals are accomplished through the use of a signal set that is composed of a deterministic spreading function, a binary random or pseudo-random noise source, and a possibly random or pseudo-random pulsing sequence. Techniques are developed for determining the parameters of the spreading function that result in signals with desirable ambiguity functions and high effective power. These techniques are based on the use of window functions for sidelobe control and the theory of chirp waveforms for effective power enhancement. Dissert. Abstr.

N81-28307 British Library Lending Div., Boston Spa (England).
THE 4 GHz AND 11 GHz MULTIBAND RADIATORS FOR PTT RADIO RELAY ANTENNAS
P. Hugli and M. Mutti Sep. 1980 16 p refs Transl. into ENGLISH from Tech. Mitt. PTT 6 (Bern), 180 p 207-211
(BLL-RDL-Trans-3852-(7737.47)) Avail: British Library Lending Div., Boston Spa, England

It is useful to employ multiband antennas if two different frequency bands must be transmitted on one radio link. The necessary radiator unit for combining 4 GHz and 11 GHz in one PTT antenna was developed. The 4 GHz band is coupled in by means of a primary focus radiator and the 11 GHz band by means of a Cassegrain system. Both bands can be transmitted simultaneously by means of vertical and horizontal polarization. E.D.K.

N81-28308 California Univ., Berkeley.
MULTIPATH-ESTIMATING RECEIVERS FOR HIGH-DATA-RATE SPREAD-SPECTRUM COMMUNICATIONS Ph.D. Thesis
Lee-Fang Wei 1980 273 p
Avail: Univ. Microfilms Order No. 8113227

In urban/suburban radio communications, a transmitted waveform is received through many different paths. This multipath channel is time-varying and unknown to the receiver. When the data rate is such that the signalling interval falls below the spread of the multipath channel, substantial intersymbol interference appears. In contending with this interference, the information received through all of the channel paths is utilized. Therefore, a spread spectrum type transmitted waveform is used so that at the receiver end the responses of the channel due to different paths and to different transmissions can be easily separated. A channel estimator, using the past estimated message digits, operates directly on the received data signal to keep track of the varying multipath channel. The behavior of the channel estimator in both the transient state and the steady state was analyzed. The effect of the errors in the estimated message digits on the steady state behavior of the channel estimator is determined. It was shown that the errors do not tend to happen in groups. Dissert. Abstr.

N81-28309 Columbia Univ., New York.
STUDIES IN INTEGRATED LINE-AND PACKET-SWITCHED COMPUTER COMMUNICATION SYSTEMS Ph.D. Thesis
Basil S. Maglaris 1980 164 p
Avail: Univ. Microfilms Order No. 8113534

The problem of efficiently allocating the bandwidth of a trunk to both types of traffic is handled for various system and traffic models. A performance analysis is carried out both for variable and fixed frame schemes. It is shown that variable frame schemes,

adjusting the frame length according to the traffic variations, offer better trunk utilization at the cost of the additional hardware and software complexity needed because of the lack of synchronization. An optimization study on the fixed frame schemes follows. The problem of dynamically allocating the fixed frame to both types of traffic is formulated as a Markovian Decision process. It is shown that the movable boundary scheme, suggested for commercial implementations of integrated multiplexors, offers optimal or near optimal performance and simplicity of implementation. Finally, the behavior of the movable boundary integrated scheme is studied for tandem link connections. Under the assumptions made for the line-switched traffic, the forward allocation technique is found to offer the best alternative among different path set-up strategies. Dissert. Abstr.

N81-28310 California Univ., Los Angeles.
A NONPROBABILISTIC SOURCE AND CHANNEL CODING THEORY Ph.D. Thesis
Martin Hassner 1981 167 p
Avail: Univ. Microfilms Order No. 8113855

An engineering interpretation is given for an isomorphism theorem proved in the context of symbolic dynaics. The latter may be viewed as the nonprobabilistic analog of ergodic theory. Contrary to Ornstein's isomorphism theorem this isomorphism results in engineering applications. Sliding block code algorithms are presented for both noiseless source and channel coding of nonprobabilistic source and channel models specified in term of a finite list of excluded blocks. The initial steps toward source coding with a fidelity criterion are described. Specifically the realistic density of errors distortion criterion is converted into a deformation of the (0,1)-matrix that describes a nonprobabilistic source. Dissert. Abstr.

N81-28311 Illinois Univ. at Urbana-Champaign.
DIFFRACTION BY PARALLEL-PLATES WITH APPLICATION TO LENS ANTENNAS Ph.D. Thesis
Leon Grun 1980 130 p
Avail: Univ. Microfilms Order No. 8108526

Scattering of an incident plane or cylindrical wave by a staggered parallel plate waveguide is examined. Of particular interest are the modal coefficients of the unattenuated modes in the waveguide when the incident field is an E wave. Several past approaches based on ray techniques are critically examined. It is found that they are not applicable when the stagger is small or when the incident field is a cylindrical valve. For the latter incidence an aperture field method is introduced in which the modal coefficients are calculated through the Fourier decomposition of the scattered field at the waveguide aperture. In order to determine this scattered field, the uniform asymptotic theory is applied for the primary contribution and the spectral theory for the first interaction. Extensive numerical data show that the aperture field method gives accurate results in canonical problems whose exact solutions are known. Dissert. Abstr.

N81-28312*# Edutel Communications and Development, Inc., Palo Alto, Calif.
THE DESIGN OF AN ULTRA-LOW SIDELOBE OFFSET-FED 1.22m ANTENNA FOR USE IN THE BROADCASTING SATELLITE SERVICE
James M. Janky Jun. 1981 156 p refs
(Contract NAS3-22344)
(NASA-CR-165368) Avail: NTIS HC A08/MF A01 CSCL 17B

A feed design and reflector geometry were determined for an ultra low sidelobe offset fed 1.22 meter antenna suitable for use in the 12 GHz broadcasting satellite service. Arbitrary constraints used to evaluate the relative merits of the feed horns and range of f/D geometries are: minimum efficiency of 55 percent, -30 dB first sidelobe level (relative to on axis gain), a 0 dBi plateau beyond the near in sidelobe region, and a Chebyshev polynomial based envelope (borrowed from filter theory) for the region from the -3 dB beamwidth points to the 0 dBi plateau region. This envelope is extremely stringent but the results of this research effort indicate that two steps of corrugated feed and a cluster array of small 1 lambda horns do meet the constraints. A set of performance specifications and a mechanical design suitable for a consumer oriented market in the broadcasting satellite service was developed. Costs for production quantities of 10,000 units/yr. are estimated to be around $150. A.R.H.

N81-28313# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PILOT PROJECT IN SATELLITE COMMUNICATION FOR EDUCATION IN BRAZIL
Nelson deJesus Parada, Neuza Maria Dias Bicudo, and Maria deLourdes N. deOliveira Apr. 1981 14 p Presented at the UN Reg. Seminar on Remote Sensing Appl. and Satellite Commun. for Educ. and Develop., Buenos Aires, 7-14 Apr. 1981
(INPE-2034-RPE/291) Avail: NTIS HC A02/MF A01

An experiment that was undertaken in Brazil to shown the feasibility of using a technological system for education in national scale based on communication satellite is discussed. A.R.H.

N81-28314*# Systematics General Corp., Falls Church, Va.
REFSAT/GPS BREADBOARD: TEST TERMINAL HARDWARE DESIGN REPORT
Nov. 1980 43 p
(Contract NAS5-26039)
(NASA-CR-166697) Avail: NTIS HC A03/MF A01 CSCL 17B

All users of the NAVSTAR Global Positioning System (GPS) located within a rather large geographical area are currently required to perform a number of identical, common operations in order to accomplish a navigation 'fix' (additional 'location dependent' operations are also required). Under the REFSAT concept, the common operations are performed at a central location and results broadcast via a geostationary reference satellite (REFSAT). This concept allows a considerable reduction in the cost and complexity of individual civil user terminals. The hardware design of a REFSAT/GPS receiver terminal and the REFSAT transmitter simulator is described. Since six of the Phase 1 NAVSTAR GPS satellites are now operational a demonstration test plan utilizing the one-to-two hour per day viewing window is also described. Equipment check-out preliminary test results are presented. A.R.H.

N81-28315*# Systematics General Corp., Falls Church, Va.
GPS/REFSAT DEFINITION STUDY REPORT FOR LOW-COST TERMINALS
Nov. 1980 68 p refs
(Contract NAS5-23433)
(NASA-CR-166696) Avail: NTIS HC A04/MF A01 CSCL 17B

A relay transponder, located either on a satellite in geostationary orbit or on a local tower to relay acquisition-aiding data, ephemerides, etc, from a ground-based remote control station to a GPS civil user terminal located on a ship or land-transportation vehicle is described. Termed REFSAT (Reference Satellite), this concept reduces the circuit complexity and cost of user terminals. The various systems needed to implement the REFSAT concept for low-cost, GPS civil terminals are defined. The GPS/REFSAT system compatible with the NAVSTAR GPS system consists of a geostationary relay satellite, civil user terminals, and the central facility which performs operations common to all users for relay via the space segment. A GPS/REFSAT system utilizing a local tower for the relay transponder is described, results of a study of civil user requirements are presented, and specifications for the GPS/REFSAT system and its individual segments are included. A.R.H.

N81-28316# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SATNET DEVELOPMENT AND OPERATION. PLURIBUS SATELLITE IMP DEVELOPMENT. REMOTE SITE MAINTENANCE. INTERNET DEVELOPMENT. MOBILE ACCESS TERMINAL NETWORK. TCP FOR THE HP3000. TCP-TAC. TCP FOR VAX-UNIX Quarterly Technical Report, 1 Feb. - 30 Apr. 1981
R. D. Bressler May 1981 71 p refs
(Contracts MDA903-80-C-0353; N00039-78-C-0405; MDA903-80-C-0214; N00039-79-C-0386; N00039-80-C-0664; N00039-80-C-0408; ARPA Order 3214; ARPA Order 3175)
(AD-A100473; BBN-4679; QTR-21) Avail: NTIS HC A04/MF A01 CSCL 17/2

This Quarterly Technical Report describes work on the

development of and experimentation with packet broadcast by satellite; on development of Pluribus Satellite IMPs; on a study of the technology of Remote Site Maintenance; on the development of Inter-network monitoring; on shipboard satellite communications; and on the development of Transmission control protocols for the HP3000, TAC, and VAX-UNIX. Author (GRA)

N81-28317# Dikewood Industries, Inc., Albuquerque, N. Mex.
EMP INTERACTION: PRINCIPLES, TECHNIQUES AND REFERENCE DATA (A COMPLEAT CONCATENATION OF TECHNOLOGY FROM THE EMP INTERACTION NOTES). EMP INTERACTION 2-1 Final Report
K. S. H. Lee AFWL Dec. 1980 765 p refs
(Contract F29601-76-C-0149; AF Proj. 3763)
(AD-A100508; AD-E200704; DC-EH-1289; AFWL-TR-80-402)
Avail: NTIS HC A99/MF A01 CSCL 20/14

This work is divided into three parts. The first part, Principles and Techniques, concerns general concepts and calculational procedures from electromagnetic theory relevant to EMP interaction. This contains a discussion of the concept of electromagnetic topology which is used to divide complex systems into somewhat natural smaller parts in an ordered way. This concept is fundamental to the organization and understanding of this work is expected to lead to further insights and computational techniques 2-8. The reader might consult a recent review paper 9 to put these in perspective including some concepts of potential future significance. The second part, Formulas and Data, considers the information concerning the pieces of the system. The organization of this part is based on the system topology, specifically the hierarchical topology which divides the system into layers. Each layer is further divided into three ordered parts: coupling, propagation, and penetration. Within each category the various individual (or canonical) types of boundary-value problems are considered. As one might expect, the bulk of the material is contained in this section. Having considered, first, the general concepts and techniques for EMP interaction and, second, the specific information concerning the pieces, we come to the third part, Systems Applications. This part attempts to illustrate the use of the previous parts in analyzing the EMP interaction with complex systems. Hypothetical system examples are chosen to illustrate the topological decomposition of the problem for selected signal paths, and the subsequent approximate calculation of the internal signals. GRA

N81-28318# Oregon Graduate Center for Study and Research, Beaverton.
WAVE PROPAGATION IN PARTICULATE MEDIA Annual Summary Report, 15 Apr, 1980 - 30 Apr. 1981
Richard A. Elliott 31 May 1981 15 p refs
(Contract N00014-79-C-0897; NR Proj. 394-045)
(AD-A100448) Avail: NTIS HC A02/MF A01 CSCL 20/6

The purpose of this project is to study optical propagation in a medium consisting of random, discrete scattering centers with a view of establishing the effects of clouds and fogs on optical communication systems. The degree of pulse stretching, power loss and beam spreading are to be determined as functions of the scattering geometry and the physical properties of the scatterers and compared with the predictions of theoretical models. An appropriate scattering medium for these experiments is an emulsion of two dielectric liquids since the indices of refraction of both the scatterers and the bulk medium can be varied by choosing different substances and the size of the droplets of the dispersed phase can be controlled by the method of preparation. In addition, emulsions can be stabilized with surfactants and can have much higher number densities than can be maintained in cloud chambers. This allows one to simulate the effect of say a kilometer of cloud in a laboratory scale scattering experiment. Author (GRA)

N81-28319# Queens Coll., Flushing, N. Y.
WIDEBAND SPEECH ENHANCEMENT ADDITION Final Technical Report, Jan. 1978 - Jul. 1980
Mark R. Weiss and Ernest Aschkenasy Griffiss AFB, N.Y. RADC May 1981 53 p refs
(Contract F30602-78-C-0063; AF Proj. 2033)
(AD-A100462; RADC-TR-81-53) Avail: NTIS HC A04/MF A01 CSCL 09/4

This report describes the completion of the development and construction of a speech enhancement unit (SEU). This is an electronic instrument that automatically detects and attenuates tones, clicks, and wideband random noises that may accompany speech signals that are transmitted, recorded, or reproduced electronically. An earlier version of this device was tested extensively by the Air Force and then was returned to Queens College for modification and completion of the system. During the period that is covered by this report, a number of major changes were made in the SEU, leading to a device that is simpler to use, more effective, and more broadly useful in its intended area or application. Some of the changes that were made in the SEU were aimed at reducing the degree of operator intervention that was required. To this end, the SEU was greatly simplified and made more automatic. The manual Digital Spectrum Shaping (DSS) system and most of the manual controls were removed. A new system was added for adjusting the level of the input signal. It keeps the signal at the level that maximizes the effectiveness of the noise attenuation processes. The INTEL process for attenuating wideband random noise was incorporated into the SEU. To make it possible for the speech enhancement unit to operate in real-time with all processes active, the hardware and software of the system were modified extensively. The MAP was upgraded by adding a second arithmetic processor and a high speed memory. The existing programs and algorithms were rewritten to reduce their execution times. These and the INTEL programs were modified to fully exploit the capabilities of the upgraded MAP. Author (GRA)

N81-28320# Rome Air Development Center, Griffiss AFB, N.Y.
MF RADIO FIELD STRENGTH MEASUREMENTS IN DESERT TERRAIN NEAR YUMA, ARIZONA
John L. Heckscher, Charles B. Kalakowsky, Roger W. Whidden, and Eli J. Tichovolsky (Arcon Corp.) Dec. 1980 21 p refs
(AF Proj. 4600)
(AD-A100238; RADC-TR-80-359) Avail: NTIS HC A02/MF A01 CSCL 20/14

The field strength of the commercial radio broadcast station KBLU was measured at several hundred locations in the desert southeast of Yuma, Arizona, to study MF ground-wave propagation over the desert valleys and mountain ridges. Field strengths below the surface of the desert floor were measured in specially drilled holes to observe the penetration of MF into the desert soil. Idealized propagation path models are shown to produce effects similar to the observations. Author (GRA)

N81-28321# Aeronautical Research Labs., Wright-Patterson AFB, Ohio. Directorate of Mission Analysis.
TARGET ACQUISITION DURING A MANNED REAL-TIME RECONNAISSANCE MISSION Technical Report, 28 Aug. 1980 - 28 Feb. 1981
Mary E. Weaver Mar. 1981 36 p refs
(AD-A100570; ASD/XRM-TR-81-5021) Avail: NTIS HC A03/MF A01 CSCL 15/4

During a manned real-time reconnaissance mission, providing target information to our military intelligence in a timely, efficient manner is of prime importance. In order to assess target information, the human observer is faced with many influencing variables. The main variables involved during target acquisition consist of the target/background, aircraft, environment, sensor display unit, and the human observer himself. Additionally, for each variable are many other elements which have some influence on the target acquisition process. In acquiring a target during a reconnaissance mission, the human observer has been found to perform this task the most efficiently and economically. Although automatic target detection methods are being pursued to take the place of the human observer, there has been no feasible method of developing a system which has the combined flexibility, programability, quick response, ability to reject clutter, ability to respond to small contrast, ability to respond to high and low ambient illumination, shape and contour matching ability, resolution, ability to detect anomalies in the scenic content, the ability to detect movement and changes, and the ability to make intuitive judgments as the human observer. In addition, the small weight and volume make the human observer a very effective and economical sensor and data analyzer. GRA

N81-28322# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE ROLE OF ENERGETIC PARTICLE PRECIPITATION IN

EXTREMELY LOW FREQUENCY (ELF) PROPAGATION ANOMALIES Final Technical Report
William L. Imhof, Robert C. Gunton, Trygve R. Larsen, Roland E. Meyerott, and Joseph B. Reagan 24 Nov. 1980 154 p refs
(Contract N00014-79-C-0175)
(AD-A100493; LMSC-D767238) Avail: NTIS HC A08/MF A01 CSCL 20/14

The purpose of the present report is to present further work on the influence of precipitating energetic particles on ELF propagation. The effort principally involves the effects of solar particle events in enhancing the conductivities of the Earth's ionosphere wave guide. Calculations have been made of the sensitivity of the ELF signal strength to changes in the conductivities over the transmitter that may occur during SPE conditions. In order to be able to calculate more accurately the changes in ELF signal strength associated with solar particle events and other disturbed conditions at twilight, new electron density data measured in the 4 August 1972 event have been used to provide increased knowledge of twilight behavior which will lead to improvements in ion chemistry modelling. The effects of the charge deposition in the polar caps on the earth's electric fields and current systems have been modeled. More realistic ambient electron and ion density daytime profiles have been proposed to provide accurate baseline signal strength calculations. GRA

N81-28323# Naval Ocean Systems Center, San Diego, Calif.
TRANSEQUATORIAL PROPAGATION OF VERY LOW FREQUENCY RADIOWAVES Final Report
F. Perry Snyder 15 Apr. 1981 110 p refs
(AD-A100373; NOSC/TD-431) Avail: NTIS HC A06/MF A01 CSCL 20/14

This study reports on observations of dawn/dusk transition fading of very low frequency radiowaves on a long, transequatorial northeasterly propagation path. A mode conversion model is developed and numerical modeling results are presented for transition fading on long transequatorial paths, both northeasterly and southwesterly. From these results the following general conclusions are drawn: (a) Anomalous transequatorial transition fading is not observed for the northeasterly propagation path. The transition fading data support completely the mode conversion model of transition fading developed by Crombie. (b) The transequatorial sunrise transition reported in the literature as anomalous is completely explained by correctly allowing for variations of the geomagnetic field along the path. The geomagnetic field influences the nighttime modal parameters to such an extent for the southwesterly path considered that the approximate WKB method of mode summation cannot be employed. (c) Careful application of model techniques appears to be capable of describing all LF and VLF propagation in the earth-ionosphere waveguide, provided the effect of the earth's magnetic field is properly included at night. However, an improved model of the ionosphere at altitudes below 100 km is desired. Author (GRA)

N81-28324# Naval Research Lab., Washington, D. C.
RADAR TARGET SIGNATURE PROGRAM PERFORMANCE SPECIFICATION Interim Report
H. L. Toothman 23 Jun. 1981 59 p refs
(S0384SL)
(AD-A100554; NRL-MR-4515) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report is a Program Performance Specification (PPS) for a digital computer program that calculates the radar signatures of ships. The PPS will be used to guide the program through three development phases and acceptance testing. The primary objectives of the program are accuracy, flexibility of application, ease of modeling, and portability. The ship is modeled by identifying and defining all the geometrical shapes which cause radar scattering and coherently adding the signals from all the appropriate ones. The program will handle far-field, near-field, and bistatic geometries, antenna patterns, radar absorbing material, and high range resolution effects. GRA

N81-28325# Analytical Systems Engineering Corp., Burlington, Mass.
PROLIFERATED GROUND-BASED, LONG WAVE, TRANSMITTING SYSTEMS. VOLUME 2: ANTENNA SUBSYSTEMS Final Report, 1 Aug. 1978 - 28 Mar. 1980
Roger Johnson 31 Mar. 1980 123 p refs
(Contract DNA001-79C-0267)
(AD-A100133; DNA-5438F-2) Avail: NTIS HC A06/MF A01 CSCL 09/5

This volume presents an evaluation of the design, performance, deployment methods, and costs for alternative VLF/LF transmitting antenna concepts. The results and findings contained in this volume (Volume 2) are used to support the feasibility assessment and cost performance trade off of proliferated ground-based, long wave, transmitting systems which is presented in Volume 1. Although the antenna concept evaluation focuses upon communication system application, the fundamental deviations are also included to enable re-evaluation of the parameters for different system design alterations. Author (GRA)

N81-28326# Army Test and Evaluation Command, Fort Huachuca, Ariz.
TROPO-SCATTER COMMUNICATIONS SYSTEMS Final Report
3 Jun. 1981 17 p Supersedes MTP-6-2-315
(Contract DAAD05-80-C-0128)
(AD-A100416; TOP-6-2-315; DRSTE-RP-702-105; MTP-6-2-315) Avail: NTIS HC A02/MF A01 CSCL 17/2

Outlines test procedures and methods for use in evaluating the performance of tropo-scatter communications systems. Includes checklist and data collection sheets. Author (GRA)

N81-28327# Army Test and Evaluation Command, Fort Huachuca, Ariz.
RADAR ANTENNA TESTS Final Report
15 Jun. 1981 32 p Supersedes MTP-6-2-020
(Contract DAAD05-80-C-0128)
(AD-A100393; TOP-6-2-020; DRSTE-RP-702-105; MTP-6-2-020) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report outlines test procedures and methods for use in evaluating the performance of radar antennas. It includes checklist and data collection sheets. GRA

N81-28328# Army Test and Evaluation Command, Fort Huachuca, Ariz.
TRANSMITTER FREQUENCY ACCURACY AND STABILITY Final Report
31 Dec. 1980 18 p Supersedes MTP-6-2-517
(Contract DAAD05-80-C-0128)
(AD-A100394; TOP-6-2-517; DRSTE-RP-702-105; MTP-6-2-517) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report outlines test procedures and methods for use in evaluating the performance of radio transmitters, specifically relating to frequency accuracy and stability, over a range from 14 KHz to 12,000 MHz. GRA

N81-28329# Army Test and Evaluation Command, Fort Huachuca, Ariz.
RECEIVER-TRANSMITTER SYSTEM TESTS. REPORT ON TEST OPERATION PROCEDURE Final Report
15 Jun. 1981 44 p refs Supersedes MTP-6-2-242 and MTP-6-2-515
(AD-A100395; TOP-6-2-242; MTP-6-2-242; MTP-6-2-515) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report outlines test procedures and methods for use in evaluating the operational performance of receivers, transmitters, and transceivers. Includes checklist and data collection sheets. GRA

N81-28330# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WORLD-WIDE LINK AVAILABILITY FOR GEOSTATIONARY AND CRITICALLY INCLINED ORBITS INCLUDING RAIN ATTENUATION EFFECTS
Leonard M. Schwab 27 Jan. 1981 84 p refs
(Contract F19628-80-C-0002)
(AD-A100436; DCA-9) Avail: NTIS HC A05/MF A01 CSCL 17/2

Link availability for constellations of satellites in geostationary and critically inclined orbits is computed using a predictor model based on the Crane 8 region worldwide rain attenuation model. The results are contrasted to percent Earth visibility computations which do not include rain attenuation. For geostationary satellite constellations, the quantitative relationship for Earth coverage

vs link margin vs availability vs number of satellites is described by a set of parametric curves. Author (GRA)

N81-28331# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AUTOMATIC RECOGNITION OF PHONEMES USING A SYNTACTIC PROCESSOR FOR ERROR CORRECTION M.S. Thesis
Robert B. Taylor Dec. 1980 90 p refs
(AD-A100807; AFIT/GE/EE/80D-45) Avail: NTIS HC A05/MF A01 CSCL 09/2

An algorithm was developed and partially implemented to integrate the use of a phoneme recognizer and a syntactic error corrector for continuous speech recognition. The recognizer uses LPC reflection coefficients as a feature set and makes decisions based on the computation of pairwise likelihood ratio tests for M phonemes. The syntactic error corrector uses a backtracking perser to perform phonological rule and grammatical error correction. A computer program is included to provide interactive training with a Tektronix 4010 terminal on a Data General NOVA/ECLIPSE computer system. Author (GRA)

N81-28332# Los Alamos Scientific Lab., N. Mex.
WHISPERING-MODE WAVEGUIDE
N. A. Kurnit 1981 37 p refs Presented at the Conf. on Optics, Santa Fe, N. Mex., 7-10 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-81-994; CONF-810429-5) Avail: NTIS HC A03/MF A01

Properties of a relatively new type of waveguide structure of potential use of confining infrared radiation to a small mode volume over long path lengths are reviewed. A single guiding surface with curvature radius rho and band radius R allows propagation of a near-grazing incidence whispering mode of transverse width approximately (lambda square root of rho R/pi) sup 1/2 and radial width approximately 1/2 (sq lambda R)/sup 1/3. For sufficiently large rho, the loss per revolution for TE mode propagation is approximately pi A/sub N/, where A/sub N/ is the normal-incidence reflection loss. Results on a number of prototype structures in general agreement with these considerations are described. DOE

N81-28333# California Univ., Livermore. Lawrence Livermore Lab.
TRANSLATION OPERATOR FOR FINITE DIMENSIONAL ELECTROMAGNETIC FIELDS
Allen Q. Howard, Jr. Apr. 1981 45 p refs
(Contract W-7405-eng-48)
(UCID-19024) Avail: NTIS HC A03/MF A01

Computation of electromagnetic fields in particular applications is usually accompanied by the adhoc assumption that the field contains a finite number of degrees of freedom. Herein, this assumption is made at the outset. It is shown that if an annular region between two closed surfaces contains no sources or sinks and is isotropic, lossless and homogeneous, unique translation operator can be defined algebraically. Conservation of energy defines the translation operator T to within an arbitrary unitary transformation. The conditions of causality, unitarity and energy conservation are shown to uniquely determine T. Both scalar and vector fields are treated. In both of these cases, frequency and time domain transforms are computed. The transform T is compared with the analagous one as derived from the time domain Stratton-Chu Formulation. The application to a radiation condition boundary constraint on finite difference and finite element computations is discussed. DOE

N81-28334# Los Alamos Scientific Lab., N. Mex.
SPS IONOSPHERE/MICROWAVE BEAM INTERACTIONS: ARECIBO EXPERIMENTAL STUDIES
Lewis M. Duncan Oct. 1980 29 p refs Submitted for publication
(Contracts DE-AI01-80ER-10160; W-7405-eng-36)
(LA-UR-80-3095) Avail: NTIS HC A03/MF A01

The environmental impacts associated with the operation of the proposed solar power satellite (SPS) microwave power transmission system. It is expected that thermal effects provide the dominant force driving the nonlinear ionosphere/microwave beam interactions. Collisional damping of radio waves, producing chemic heating of the ionospheric plasma, depends inversely on the square of the radio wave frequency. Therefore, equivalent heating and equivalent thermal forces can be generated at lower radiated power densities by using lower radio wave frequencies. Instability thresholds, the growth rates and spatial extent of the resultant ionospheric disturbances, and the frequency and power dependences of interactions are considered. How these interactions are affected by variations in the natural ionospheric conditions, how different instabilities occurring simultaneously may affect each other, and how distinct microwave beams might mutually interact are studied. DOE

N81-28335# Kiruna Geophysical Inst. (Sweden).
INCOHERENT SCATTER RADAR MEASUREMENTS IN THE AURORAL ZONE
J. Murdin 1980 18 p refs
(KGI-80-2; ISSN-0347-6405) Avail: NTIS HC A02/MF A01

The geometry of the UHF tristatic system in the EISCAT incoherent scatter facility is described and the effective scattering volume of the radar in the ionosphere is evaluated as a function of the position of the scattering point and the transmitted pulse length. The relative merits of operating the radar with linear and circular polarization are discussed. A method of determining the errors in the plasma parameters, measured by incoherent scatter radar, through the use of a simulation of the radar system is described. Under favorable circumstances the EISCAT UHF radar can make meaningful measurements of electron density, electron temperature, and ion temperature with a height resolution of a few kilometers and in a matter of seconds. Measurements made by the Chatanika incoherent scatter radar over a three day period are investigated. An empirical relationship between the heat input to the neutral atmosphere and the ground magnetic disturbance is obtained. A technique for interpreting monopulse radar measurements made in the E-region is described and used to determine the ion neutral collision frequency.
Author (ESA)

N81-28336# Fondazione Ugo Bordoni, Rome (Italy).
INTEGRATED TEXT-COMMUNICATION SERVICES DIGITAL NETWORKS
Roberto Montemurro and Francesco Villani Dec. 1980 24 p refs
(FUB-38-1980) Avail: NTIS HC A02/MF A01

Circuit and packet switched facilities as well as distributed information processing units handling new text communication services are part of future integratd services digital networks. The functional integration of text communicaton procedures with the digital network is discussed. Unified handling of batch and interactive text communications is proposed. The use of standardized protocols at both transport and user service levels is suggested. The implementation of transport service layered functions into actual hierarchical communication levels is examined. It is shown possible to define standardized protocols common to both circuit switched and packet switched operating facilities. The text communication functions pertaining to session and presentation tasks are described. A session protocol common to both batch and interactive services is envisaged and real as well as virtual presentation services are considered.
Author (ESA)

N81-28337# Fondazione Ugo Bordoni, Rome (Italy).
ANALYSIS PROCEDURES AND DATA PRESENTATION FOR THE COST PROJECT INVESTIGATIONS ON CROSS-POLARIZATION AND RAIN STRUCTURAL MODELS [SISTEMATIZZAZIONE DI PROCEDURE DI ANALISI E PRESENTAZIONE DATI PER INDAGINI IN AMBITO COST SULLA CROSS-POLARIZZAZIONE E SULLA MODELLISTICA STRUCTTURALE DELLE PRECIPITAZIONI]
Aldo Paraboni (Polytech. of Milan) Dec. 1980 52 p refs In ITALIAN
(FUB-39-1980) Avail: NTIS HC A04/MF A01

Unified procedures are presented for data processing rain/propagation interaction data for the European COST project for Earth to satellite microwave transmission links. The relationship between rain structure and attenuation due to rain is analyzed, and the pertinet physical models are described. Parameters, algorithms, and computation procedures are defined. The Fedi algorithm is used in the direct or inverse sense in

order to obtain the rain point distribution from the attenuation distribution. The Misme-Fimbel transformation is shown to be a particular case of a general statistical modes overlapping principle. Charts relating the various parameters as computation examples based on Sirio satellite data are given. Author (ESA)

N81-28338# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL ANALYSIS OF A GENERAL METHOD OF CHARACTER ALIGNMENT [ANALISI STATISTICA DI UN METODO GENERALE D'ALLINEAMENTO DI CARATTERE]
Odoardo Brugia, Giovanni Campanini, and William Wolfowicz Dec. 1980 89 p refs In ITALIAN
(FUB-40-1980) Avail: NTIS HC A05/MF A01

A general procedure of character alignment is described and the statistical properties resulting from its application are analyzed. The method is based on the rate analysis of violations of code parity or compatibility conditions. The average and maximum values of the alignment holding time, the disalignment detection time, and the alignment recovery time which characterize the procedure performance are defined and discussed. Examples of applications are given refering to the 5B-6B code in optical fiber transmission and the Fomot code in coaxial cable transmission. Author (ESA)

N81-28339# Fondazione Ugo Bordoni, Rome (Italy).
JITTER COMPUTATION USING THE POWER AND PHASE SPECTRA OF THE PAM SIGNALS: COMPARISON WITH RESULTS OBTAINED BY SIMULATION [CALCOLO DEL JUTTER CON IL METODO DEGLI SPETTRI DI POTENZA E DI FASE DEL SEGNALE PAM: CONFRONTO CON I RISULTATI OTTENUTI MEDIANTE PROCEDURE DI SIMULAZIONE]
Domenico DeSeta, Renato Lucarelli, Wolfango Maggi, and Giuseppe Maria Poscetti (Rome Univ.) Dec. 1980 32 p refs In ITALIAN
(FUB-41-1980) Avail: NTIS HC A03/MF A01

A theoretical jitter model for a regenerative repeater timing circuit is described. A method for jitter calculation is derived consisting of a frequency domain analysis based on a particular definition of the phase spectra of the pulse amplitude modulation signals which show random characteristics. A particular case characterized by binary sequences with independent and equiprobable symbols, and with equalized pulse shape given by an analytical expression is examined. The rms jitter value is calculated for various Q factors and syntony errors. Comparison with results from computerized simulation shows quantitative differences which are larger for higher Q factors and syntony errors. Author (ESA)

N81-28340# Fondazione Ugo Bordoni, Rome (Italy).
PULSE RESPONSE AND PHASE JITTER MEASUREMENT IN FDM SYSTEMS SERVED BY THE SIRIO TELECOMMUNICATIONS SATELLITE [MISURE DI RISPOSTA ALL'IMPULSO DI JITTER DI FASE SU SISTEMI FDM, CON TRATTE SERVITE DAL SATELLITE PER TELECOMUNICAZIONI SPIRO]
Domenico DeSeta, Giorgio Fruscalzo, and Wolfango Maggi Sep. 1980 16 p In ITALIAN
(FUB-42-1980) Avail: NTIS HC A02/MF A01

The measuring procedures for pulse response and phase jitter in two telephonic links between Rome and Turin are described. Pulses of 1 volt amplitude, 50 microsecond duration and 7 Hertz repetition frequency were used. A phase demdoulator was utilized for phase jitter measurements. Terrestrial, via satellite, and mixed loops were examined. The most probable value of the peak to peak jitter is 3 to 4 deg. The loops served by the Sirio satellite show a slightly poorer jitter performance than the purely terrestrial links. The wave shape of the pulse response are similar to the signals obtained by use of a 300 to 3400 Hz telephonic filter. Author (ESA)

N81-28341# Fondazione Ugo Bordoni, Rome (Italy).
DATA PROCESSING OF FUNDAMENTAL FREQUENCY DATA IN TELEPHONIC SIGNALS [ELABORAZIONE DEI DATI RELATIVI ALLA FREQUENZA FONDAMENTALE ESTRATTA DA SEGNALI DI TIPO TELEFONICO]
Giulio Masserano Dec. 1980 54 p In ITALIAN
(FUB-45-1980) Avail: NTIS HC A04/MF A01

Voice fundamental frequency data obtained using an average magnitude difference function are further processed to reduce the evaluation error, in particular the double pitch error. Three algorithms are described and compared. An experimental assessment of the proposed algorithms is presented given a digitized male voice signal sampled at 10 kHz. One of the algorithms which simply eliminates the anomalous values of the fundamental frequency is found to be the best suited for error reduction. The simplicity of this algorithm, which allows for fast data processing, is emphasized. Author (ESA)

N81-28342# Fondazione Ugo Bordoni, Rome (Italy).
PRELIMINARY EXPERIMENTS OF PHONETIC TRANSCRIPTION OF CONNECTED SPEECH [ESPERIMENTI PRELIMINARI DI TRASCRIZIONE FONETICA DEL PARLATO CONNESSO]
Foster Bianchi, Paolo Pocci, and Lucio Prina-Ricotti Dec. 1980 17 p In ITALIAN
(FUB-46-1980) Avail: NTIS HC A02/MF A01

Experiments on phoneme recognition were carried out within a phonetic transcriptor development program. Only four phonemes were used in all possible combinations, spoken by four different male and four female speakers. The signals were band filtered using FIR filters. Homotopic product correlations were obtained from the filtered signals. The patterns which characterize each phoneme were found by averaging the patterns of all speakers with the phoneme located at the begiming of the spoken word. These patterns were incorporated in a computer program for phoneme recognition. After analysis of 320 phonemes, 16 are not recognized and 7 are uncertain. The most frequent errors concern the R phoneme. Compensation for these errors is discussed. Author (ESA)

N81-28343# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
PROGRAM TO IMPROVE UHF TELEVISION RECEPTION Final Report
W. R. Free, J. A. Woody, and J. K. Daher Sep. 1980 216 p (Contract FCC-0315)
(PB81-175341) Avail: NTIS HC A10/MF A01 CSCL 17B

Performance characteristics of various components of a television receiving antenna system are investigated. Antennas, transmission lines, baluns, splitters, and band separators were evaluated. Measurement results are compiled and evaluations of both components and complete receiving antenna systems are presented. Performance characteristics of fifty five antenna configurations were studied. J.D.H.

N81-28344# Stanford Univ., Calif.
NEW TECHNICAL OPPORTUNITIES FOR UHF TELEVISION TRANSMITTERS
C. Chapin Cutler Feb. 1981 56 p refs Revised (Contract FCC-137193)
(PB81-175358) Avail: NTIS HC A04/MF A01 CSCL 17B

Prospects for improvements in the area of UHF television transmitter efficiency are investigated. Conventional klystrons, tetrodes, extended interaction gap klystrons, transistors, and multi-element depressed collector klystrons are considered. The multi-element depressed collector is determined to be the most promising contender for improved efficiency in UHF television. Estimates of its efficiency ranged as high as 30 percent which would put UHF and VHF power generation on a par. J.D.H.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-28345 British Library Lending Div., Boston Spa (England).
THERMIONIC EMISSION FROM BARIUM TUNGSTATE EMITTERS AND ITS EFFECT ON MERCURY LAMPS

K. Watanabe and M. Saito Jan. 1981 22 p refs Transl. into ENGLISH from Shomei Gakkai Zasshi (Japan), v. 62, no. 4 1978 p 175-180
(BLL-RTS-11966) Avail: British Library Lending Div., Boston Spa, England

The use of barium tungstate as the emitter substance for high pressure mercury lamp electrodes is investigated. Barium tungstate incorporating strontium and calcium was combined with aluminum oxide or yttrium oxide, and the thermonic emission and evaporation rate determined. The thermionic emission and evaporation rate were investigated in relation to lumen emittance and starting voltage in high pressure mercury lamps utilizing the emitters. Deterioration in luminous flux was dependent on the rate of evaporation, and the work function of the emitters was dependent on the starting voltage of the lamp. J.D.H.

N81-28346 British Library Lending Div., Boston Spa (England).
ON THE BEHAVIOR OF PALLADIUM ELECTRODEPOSITS ON ELECTRICAL CONTACTS IN COMPARISON TO GOLD LAYERS
H. Grossmann et al Oct. 1980 9 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 71, no. 5, 1980 p 484-488
(BLL-RTS-12405) Avail: British Library Lending Div., Boston Spa, England

The chemical behavior of palladium coatings was investigated in the presence of corrosive gases and organic vapors from plastics as well as in temperature changes. Studies of the electroplated contact layers of 3 micrometer thickness show that palladium comes very close to high carat gold with 99.5 percent Au. Although not recommended as a universal substitute for gold, palladium behaves better that low carat gold layers with copper/cadmium additions. A.R.H.

N81-28347 California Univ., Berkeley.
ENERGY-RELATED CONCEPTS FOR NONLINEAR TIME-VARYING N-PORT ELECTRICAL NETWORKS: PASSIVITY AND LOSSLESSNESS Ph.D. Thesis
Joel Wright Gannett 1980 178 p
Avail: Univ. Microfilms Order No. 8113039

Consistent definitions of passivity and losslessness are formulated which apply to n-port electrical networks which are not necessarily linear, time variant, or lumped. Passively and losslessness conditions for nonlinear n-ports which can be mathematically represented by a finite order dynamical system verifiable without solving the state equation are found. A general theory is presented, consistent definitions of the concepts of passivity and losslessness are formulated, and various consequences of these definitions are presented and discussed. For the class of finite order dynamical systems, a number of significant results are obtained. The Smoothness Conjecture is shown to be false by producing a counterexample. Nontrivial sufficient and necessary algebraic conditions for passivity and losslessness are obtained. For first order time invariant dynamic systems, algebraic conditions for passivity and losslessness are obtained which are both necessary and sufficient. A complete, rigorous treatment of passivity and losslessness for linear time invariant finite order dynamical systems is presented. Dissert. Abstr.

N81-28348 Cincinnati Univ., Ohio.
DEVELOPMENT AND EVALUATION OF A MICROPROCESSOR CONTROLLED TWIN WORKING ELECTRODE POTENTIOSTAT Ph.D. Thesis
David Wayne Paul 1981 313 p
Avail: Univ. Microfilms Order No. 8115389

The four electrode potentiostat improves the anodic stripping voltammetry (ASV) technique for analyzing trace metal ions in environmental samples by removing the interference in analysis of one metal due to the presence of another. The interfering metal ion is deposited onto one of the working electrodes and then the remaining electrode is used to perform ASV. The instrumentation includes a four electrode potentiostat allowing for independent potential control over each working electrode, an interface to a 6502 microprocessor, and 60 Hz line noise elimination. A high level interpretive language, FOCAL, was modified into a real time language. Minor modifications in the software make possible implementation of different voltammetric techniques. A thin layer study of the Cu-Zn intermetallic complex was performed using differential pulse ASV. The intermetallic effect observed using a 1 to 1 ratio of Cu to Zn at the 50 ppb level was eliminated by the procedure. Dissert. Abstr.

N81-28349 State Univ. of New York at Buffalo.
A NONLINEAR MACROMODEL OF THE BIPOLAR INTEGRATED CIRCUIT OPERATIONAL AMPLIFIER FOR ELECTROMAGNETIC INTERFERENCE ANALYSIS Ph.D. Thesis
Gordon Kowa Cheng Chen 1981 136 p
Avail: Univ. Microfilms Order No. 8114656

A nonlinear macromodel for the bipolar transistor integrated circuit operational amplifier is derived from the macromodel proposed by Boyle. The nonlinear macromodel contains only two nonlinear transistors in the input stage in a differential amplifier configuration. Parasitic capacitance effects are represented by capacitors placed at the collectors and emitters of the input transistors. The nonlinear macromodel is effective in predicting the second order intermodulation effect of operational amplifiers in a unity gain buffer amplifier configuration. The nonlinear analysis computer program NCAP is used for the analysis. Accurate prediction of demodulation of amplitude modulated RF signals with RF carrier frequencies in the 0.05 to 100 MHz range is achieved. The macromodel predicted results, presented in the form of second order nonlinear transfer function, come to within 6 dB of the full model predictions for the 741 type of operational amplifiers for values of the second order transfer function greater than -40 dB. Dissert. Abstr.

N81-28350 Wisconsin Univ. - Madison.
THE PERFORMANCE OF THE VOLTAGE SOURCE EXCITED CSI INDUCTION MACHINE DRIVE Ph.D. Thesis
Hohamed Elkader Abbas 1980 297 p
Avail: Univ. Microfilms Order No. 8107008

The steady state and dynamic performance of a voltage excited current source inverter (CSI) induction machine drive is investigated. For the steady state, a fundamental component per phase equivalent circuit which correctly represents the transfer relations of the CSI is presented. A complete steady state analysis for the open loop drive based on this equivalent circuit combined with the conventional stator referred equivalent circuit of the induction machine is presented for motoring, regenerating and self excitation modes. The effects of slip frequency control and volts/Hz control schemes on the steady state characteristics in the motoring mode are also investigated. A stability analysis is carried out using a synchronously rotating reference frame linearized model in terms of nondimensional parameters that reduce the number of parameters required to fully describe the drive to six instead of twelve. The effect of different control schemes on the dynamics of the drive is investigated. Author

N81-28351 Connecticut Univ., Storrs.
DEVELOPMENT AND MODELING OF A NEW FAMILY OF INJECTION-GATED DOUBLE-INJECTION SWITCHING DEVICES Ph.D. Thesis
Ashok Kumar Kapoor 1981 258 p
Avail: Univ. Microfilms Order No. 8115377

Double injection (DI) devices consisting of diodes for hole and electron injection into a high resistivity semiconductor substrate containing deep traps are discussed. The DI diodes exhibit S-type switching. To control the switching behavior of the DI devices, a p(+) gate is diffused in the chanel region between the anode and the cathode. The devices are fabricated using conventional microfabrication technology. The SCR like behavior of DI devices is described. Holding voltage can be reduced to zero, or to a negative voltage, by applying sufficient negative gate cathode bias. An optimum location for the gate placement in the channel was sought. The post threshold behavior of the devices is investigated. The DI diodes show pulse width modulation (PWM) effect. The PW effect is characterized in terms of the dwell time. Transient behavior of the three terminal device is described. The behavior of the DI devices is analyzed and modeled. Dissert. Abstr.

N81-28352*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL PREDICTION AND EXPERIMENTAL VERIFI-

CATION OF PERFORMANCE AT VARIOUS OPERATING CONDITIONS OF A DUAL-MODE TRAVELING WAVE TUBE WITH MULTISTAGE DEPRESSED COLLECTORS
James A. Dayton, Jr., Henry G. Kosmahl, Peter Ramins, and Norbert Stankiewicz Jul. 1981 27 p refs
(NASA-TP-1831; E-577) Avail: NTIS HC A03/MF A01 CSCL 09C

A comparison of analytical and experimental results is presented for a high performance dual-mode traveling wave tube (TWT) operated over a wide range conditions. The computations are carried out with advanced multidimensional computer programs. These programs model the electron beam as a series of disks or rings of charge and follow their trajectories from the rf input of the TWT through the slow-wave structure refocusing system to their points of impacts in the depressed collector. TWT performance, collector efficiency, and collector current distribution are computed and compared with measurements. Very good agreement was obtained between computed and measured TWT performance and collector efficiencies, and the computer design of a highly efficient collector was demonstrated. Author

N81-28353*# Westinghouse Research and Development Center, Pittsburgh, Pa.
HIGH-CURRENT, FAST-SWITCHING TRANSISTOR DEVELOPMENT Final Report
P. L. Hower 15 Mar. 1981 48 p refs
(Contract NAS3-21380)
(NASA-CR-165372; Rept-81-9F5-LTRAN-R1; DYD-10892-CE) Avail: NTIS HC A03/MF A01 CSCL 09C

The design, wafer-processing techniques, and various measurements which include forward safe operating area, dc characteristics, and switching times are described for a larger-diameter (33) transistor. An improved base contact for equalizing the base-emitter voltage at high currents was developed along with an improved emitter contact preform which increases the silicon area available for current conduction. The electrical performance achieved is consistent with the proposed optimum design. A.R.H.

N81-28354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSFER-MATRICES FOR SERIES-TYPE MICROWAVE ANTENNA CIRCUITS
R. F. Schmidt Apr. 1981 32 p refs
(NASA-TM-82054) Avail: NTIS HC A03/MF A01 CSCL 09C

Transfer matrices are developed which permit analysis and computer evaluation of certain series type microwave antenna circuits associated with an L-Band microwave radiometer (LBMR) under investigation at Goddard Space Flight Center. This radiometer is one of several diverse instrument designs to be used for the determination of soil moisture, sea state, salinity, and temperature data. Four port matrix notation is used throughout for the evaluation of LBMR circuits with mismatched couplers and lossy transmission lines. Matrix parameters in examples are predicted on an impedance analysis and an assumption of an array aperture distribution. The notation presented is easily adapted to longer and more varied chains of matrices, and to matrices of larger dimension. A.R.H.

N81-28355*# Bendix Corp., Teterboro, N. J. Guidance Systems Div.
CHARGE INJECTION DEVICE EVALUATION HARDWARE Final Report
30 Apr. 1981 17 p
(Contract NAS8-33740)
(NASA-CR-161827) Avail: NTIS HC A02/MF A01 CSCL 09C

A microprocessor based system which provides maximum testing flexibility via software reconfiguration is described. This system has the capability to evaluate a charge injection device (CID) and to characterize its performance. The construction and operation of the CID offer advantages over the various CCD configurations available. These advantages include a less sophisticated manufacturing process, no images smearing during readout, high transfer efficiencies, and high resistance to blooming due to optical overload. T.M

N81-28356# Bendix Corp., Baltimore, Md. Communications Div.
TACTICAL MINIATURE CRYSTAL OSCILLATOR Final Report, 15 Apr. 1975 - 1 Oct. 1980
H. M. Greenhouse, R. L. McGill, W. Fefel, H. Jackson, D. Brown, R. Bryan, and T. Hawkins Apr. 1981 146 p refs
(Contract DAAB07-75-C-1327)
(AD-A100374; BCD-FR-81-1327; DELET-TR-75-1327-F) Avail: NTIS HC A07/MF A01 CSCL 09/1

The intended use for the Tactical Miniature Crystal Oscillator (TMXO) is as a reference frequency source in advanced tactical communications systems and in time ordered navigational systems. This effort, conducted in 2 phases, was a continuation by the authors of a previous study which defined particular problem areas. The TMXO as configured in this effort is an evacuated enclosure containing a thermal insulating pedestal, a vacuum sealed hybrid microcircuit and a precision quartz crystal unit. Phase 1 utilized chip and wire microelectronic construction and a custom crystal unit in a metallic enclosure approximating the thermal characteristics of the new ceramic flatpack enclosed crystal unit in development. Phase 2 used thick film technology in conjunction with early developmental ceramic enclosed crystal units. This final report includes all the work of phases 1 and 2. GRA

N81-28357# Varian Associates, Palo Alto, Calif.
INTERACTION STRUCTURES FOR NARROW-BAND MILLIMETER-WAVE COMMUNICATIONS TWTS Final Technical Report, Jun. 1979 - Aug. 1980
Arthur Karp Griffiss AFB, N.Y. RADC Apr. 1981 120 p refs
(Contract F30602-79-C-0172; AF Proj. 4506)
(AD-A100461; RADC-TR-81-54) Avail: NTIS HC A06/MF A01 CSCL 09/1

This program was devoted to the investigation and development of new slow-wave interaction-structure technology benefiting narrow-band non-helix TWTs for millimeter-wave space-communications application. One recently introduced group of inherently narrow-band structures uses a one-piece copper-slab ladder enclosed in various simple ways to yield the equivalent of a chain of cavities with staggered or in-line, magnetic or electric coupling between them. A major objective is to assemble only a few pieces, regardless of the number of cavities in the chain. This objective also applies to the narrowest-band embodiments of a recently introduced novel slow-wave interaction-structure approach - 'Comb-Quad' - likewise promising to alleviate fabrication difficulties, better retain dimensional precision and reduce costs relative to conventional axially stacked coupled-cavity chains at a given frequency such as 44 or 94 GHz. These new structures are mechanically and thermally robust, low in attenuation, and in particular offer electrical equivalence without sacrifice of interaction impedance. The narrow-band design evaluations were based on analytic techniques and scale-model cold testing. The circuit aspects investigated included dispersion, RF fields and currents, attenuation, interaction impedance extraneous modes and passbands, thermal effects, actual-size fabrication techniques, and the effects of several categories of geometric imperfection. GRA

N81-28358# Naval Biodynamics Lab., New Orleans, La. Bureau of Medicine and Surgery.
SOME USEFUL FILTER FORMS
Gilbert C. Willems Jun. 1980 52 p refs
(M0097PN001)
(AD-A100452; NBDL-80R005) Avail: NTIS HC A04/MF A01 CSCL 09/1

A compilation of second order filters of the most common types used in signal conditioning is presented herein. All are derived from the minimum phase second order transfer function, and both analog and digital implementations are considered. The illustrations for each filter mechanization contain all essential design information; in this manner they can be used independently as a design aid of the text. Author (GRA)

N81-28359# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Microwave Technology Branch.
STUDY AND CHARACTERIZATION OF TM SUB ONO CYLINDRICAL RESONANT CAVITY COMBINERS Final

Report, Jan. - Dec. 1980
Donald L. Allen Apr. 1981 86 p refs
(AF Proj. 2002)
(AD-A100491; AFWAL-TR-81-1017) Avail: NTIS HC A05/MF A01 CSCL 09/1

In this investigation the TMono cylindrical resonant cavity combiner is studied and characterized with the objective of improving the understanding of the design parameters of this microwave circuit. The study portion of the investigation involves presenting the fundamental theory of the cylindrical resonant cavity and coaxial diode circuits which make up a cylindrical resonant cavity combiner, the general modelling of two-port resonant cavities, and the equivalent circuit impedance relations of the Kurokawa combiner model (2) which has been widely used by researchers in this area. The objective of using this model was to examine its applicability to higher-order TMono mode combiners. The characterization section includes the passive two-port measurement of impedance transmission coefficient on a TM020 test combiner under various circuit conditions. A correlation between the measured and calculated impedance at a single coaxial line is presented and the results demonstrate that the Kurokawa model generally replicates the measured response. However, it is shown that there exists a relationship between the coupling coefficient at the cavity/coaxial line interface and the number of coaxial lines which must be included in the Kurokawa model. The results of the transmission measurements indicate that to achieve maximum combining efficiency, a high unloaded cavity Q must be maintained (i.e., through the use of small coaxial lines) and that the microwave absorber characteristic impedance must be minimized without causing instability in operation with IMPATT diodes. Author (GRA)

N81-28360# Minnesota Univ., St. Paul. Dept. of Electrical Engineering.
ADAPTIVE HIGH RESOLUTION SPECTRAL ANALYSIS WITH NOISY DATA Final Report, 16 Jun. 1978 - 15 Dec. 1980
M. Kaveh Dec. 1980 91 p refs
(Contract AF-AFOSR-3628-78; AF Proj. 2304)
(AD-A100319; AFOSR-81-0489TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report summarizes the results of research during the past two years, in understanding the resolution of the autoregressive (AR) spectral estimators and developing and evaluating computationally efficient autoregressive-moving average (ARMA) spectral estimators. The loss in the resolution of the AR spectral estimator in the presence of noise is related to the appearance of zeros in the z-plane. A parallel resonator model is developed to relate the loss in resolution (bandwidth expansion) to the signal-to-noise ratio and parameters of the noiseless signal model. A new technique for the identification of the order of an AR model was derived that shows substantial stability compared to the popular Akaike Information Criterion method. Order determination was emphasized, since increase in the order of the AR spectral estimator, to account for the presence of noise, is naturally accompanied by larger variance of the estimates and appearance of spurious peaks. Several sub-optimum (non-maximum-likelihood) ARMA spectral estimators were also developed. These methods are computationally efficient, but statistically not very stable for small data records. An evaluation of the statistical properties of the different sub-optimum ARMA techniques led to the evaluation of asymptotic bounds on the variances of the estimates of the parameters or the poles and zeros of the model through the evaluation of Fisher's information matrix. GRA

N81-28361# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
APPLICATION OF SURFACE ANALYSIS TECHNIQUES TO PULSED POWER PROBLEMS Interim Report
G. L. Jackson 23 Mar. 1981 146 p refs
(Contract F49620-79-C-0191; AF Proj. 2301)
(AD-A100971; AFOSR-81-0501TR; AFOSR-PP-1) Avail: NTIS HC A07/MF A01 CSCL 09/1

An assessment of some of the advantages and disadvantages of various surface analysis techniques applied to the analysis of both the insulators and conductors used in high voltage spark gaps is presented. Some of the analysis techniques introduced include Electron Spectroscopy for Chemical Analysis, Auger Electron Spectroscopy, X-ray Fluorescence, and Secondary Ion Mass Spectroscopy. The purpose of this review is to present some of these analysis techniques with emphasis placed on those techniques which give information about changes that occur on or near the surfaces on insulators and conductors. Surface charging makes most analysis techniques incapable of giving useful information about the changes on or near the surface of insulators. Because of the amount of information available from a single ESCA spectrum, such as shifts in binding energies due to changes in chemical environment, Auger electron peaks due to the relaxation of the atom after photoionization, and the quantitative information, ESCA is the best analysis technique available for the investigation of insulators. Also the problem of surface charging in ESCA is minimal. The analysis of conductors, however, is less complicated because surface charging is no longer a problem. Therefore, the use of AES, SIMS, and ESCA can all give some useful information about conductor surfaces. GRA

N81-28362# Encoth Corp., Princeton, N.J.
SENSITIVITY OF THE CURRENT-VOLTAGE CHARACTERISTIC TO DIODE PARAMETERS Final Report
M. I. Stoenescu, Ralph A. Nichols, Arthur W. Brooks, and Timothy M. Smith Jan. 1981 28 p
(Contract DE-AC02-79ET-15422)
(DOE/ET-15422/7) Avail: NTIS HC A03/MF A01

The physical description of the electrodes and of the plasma is transferred to one point of the diode volt-ampere characteristic represented by one value of the current density J at given output voltage V. The origin of losses of the diode electric current at higher voltages and the impact on the diode performance of modifications on electrode surface, geometry, and physics of the outer electrode region are analyzed. The choice of the mathematical representation and technique is dictated by the present treatment being a subensemble of a two dimensional mathematical model. DOE

N81-28363# Brookhaven National Lab., Upton, N. Y. National Synchrotron Light Source.
HIGHER-ORDER TERMS IN A PERTURBATION EXPANSION FOR THE IMPEDANCE OF A CORRUGATED WAVEGUIDE
S. Krinsky and R. L. Gluckstern (Maryland Univ., College Park) 1981 3 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(BNL-29213; CONF-810314-72) Avail: NTIS HC A02/MF A01

A circular waveguide is considered whose radius a(z) = a(1+ epsilon s(z)) varies periodically with the axial coordinate z. Chatard-Moulin and Papiernik introduced a perturbation expansion in powers of epsilon for the longitudinal impedance of such a waveguide. The derivation of this expansion is reformulated in a manner which elucidates the structure of the higher-order terms, and allows the determination of the dependence on epsilon of the resonant frequencies. For a square-wave (SW) wall distortion, there are divergent coefficients in the perturbation expansion. Hence, a special treatment is required in this case, and a calculation of the resonant behavior is presented for small epsilon, using an approach which does not assume an expansion in powers of epsilon. The resulting expression for the resonant impedance involves functions singular at epsilon = 0; however, to leading order in epsilon, the loss-factors and resonant frequencies are in agreement with perturbation theory. DOE

N81-28364# Los Alamos Scientific Lab., N. Mex.
NOVEL CURRENT MONITOR FOR dc AND MODULATED MAGNETS IN THE PROTON STORAGE RING
Burton R. Sandberg 1981 4 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-781; CONF-810314-106) Avail: NTIS HC A02/MF A01

An analytical description is given of the zero flux dc current transformer. The method of demodulating the dc chanel uses a time domain scheme rather than the usual second harmonic method. L.F.M.

N81-28365# Sandia Labs., Albuquerque, N. Mex. Diagnostic Div.

MEASUREMENT OF MAGNETICALLY INSULATED LINE VOLTAGE USING A THOMSON PARABOLA CHARGED PARTICLE ANALYSER

T. D. Stanley and Regan W. Stinnett 1981 24 p refs Presented at the Workshop on Meas. of Elect. Quantities in Pulsed Power Systems, Boulder, Colo., 2 Mar. 1981

(Contract DE-AC04-76DO-0789)

(SAND-80-2685C; CONF-810325-1) Avail: NTIS HC A02/MF A01

Direct measurements of magnetically insulated transmission line peak voltages are presented. The peak voltage is measured by observing the energy of negative ions produced at the line cathode and accelerated through the line voltage. The ion energy and the charge-to-mass ratio are measured using the Thomson Parabola mass spectrometry technique. This technique uses parallel E and B fields to deflect the ions. The deflected ions are detected using a microchannel plate coupled to a phosphor screen and photographic film. The Thomson Parabola results are compared to Faraday Cup measurements and to calculated voltages based on current measurements. In addition, the significance of observed positive ions is discussed. DOE

N81-28366# Institut de Recherche de l'Hydro-Quebec, Varennes.

REAL-TIME DIGITAL DATA-ACQUISITION SYSTEM FOR DETERMINING LOAD CHARACTERISTICS. VOLUME 2: OPERATING, PROGRAMMING AND MAINTENANCE INSTRUCTIONS Final Report

B. Podesto, A. Lapointe, G. Larose, Y. Robichaud, and C. Vaillancourt Mar. 1981 148 p refs Sponsored by EPRI

(EPRI Proj. 849-2)

(EPRI-EL-851-Vol-2) Avail: NTIS HC A07/MF A01

The design and construction of a Real-Time Digital Data Acquisition System (RTDDAS) to be used in substations for on-site recording and preprocessing load response data were included. The gathered data can be partially processed on site to compute the apparent, active and reactive powers, voltage and current rms values, and instantaneous values of phase voltages and currents. On-site processing capability is provided for rapid monitoring of the field data to ensure that the test setup is suitable. Production analysis of field data is accomplished off-line on a central computer from data recorded on a dual-density (800/1600) magnetic tape which is IBM-compatible. Parallel channels of data can be recorded at a variable rate from 480 to 9000 samples per second per channel. The RTDDAS is housed in a 9.1 m (30-ft) trailer which is shielded from electromagnetic interference and protected by isolators from switching surges. The test must sometimes be performed. Information pertaining to the installation, software operation, and maintenance is presented. DOE

N81-28367# Colorado Univ., Boulder. Nuclear Physics Lab.

NUMERICAL CALCULATION OF THE THREE DIMENSIONAL ELECTRICAL FIELD IN THE CENTRAL REGION OF A CYCLOTRON

Mao-bai Chen (Shanghai Inst. of Nuclear Research) and D. A. Lind 1981 3 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11 Mar. 1981

(Contract DE-AC02-81ER-40014)

(DOE/ER-40014/1; CONF-810314-39) Avail: NTIS HC A02/MF A01

To provide detailed and accurate maps of electric field contours in the ion source puller region and at the dee dummy dee gap for a cyclotron, a relaxation method solution of the Laplace equation is used. A conventional difference equation with variation in mesh size and relaxation factor as well as different schemes for boundary corrections is developed to achieve roughly 1 percent accuracy for a three dimensional domain with 1 million mesh points. Although the computation requires considerable computer time, it is much less expensive than electrolytic tank analogue methods for measuring field distributions around complex electrode configurations. DOE

N81-28368# Tennessee Technological Univ., Cookeville. Dept. of Chemical Engineering.

OPERATING TEMPERATURES OF RECESSED FLUORESCENT FIXTURES WITH THERMAL INSULATION

D. W. Yarbrough and I. A. Toor May 1981 22 p refs

(Contract W-7405-eng-26)

(ORNL/Sub-7715/4) Avail: NTIS HC A02/MF A01

Tests were performed to determine steady state surface temperatures for recessed fluorescent fixtures operated with and without thermal insulation with the installation of thermal insulation. In addition to measuring temperatures, means were sought by which the fixtures can be thermally insulated and operated without fire hazards or damage to the fixture. DOE

N81-28369# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.

REQUIREMENTS FOR REPAIR AND MODIFICATION OF SPACE-STANDARD PRINTED CIRCUIT BOARDS AND SOLDER JOINTS

Paris ESA Oct. 1980 39 p

(ESA-PSS-55(QRM-28P)-ESTEC-1; ISSN-0379-4059) Avail: NTIS HC A03/MF A01

Allowable repairs for printed circuit assemblies damaged during assembly or testing are detailed. Board modifications are limited to the revision of interconnecting features by interrupting conductors and/or added components. Plating and wire joint defects are defined. Tools, materials and procedures are shown for removal of conformal coatings, and for solder joint removal as well as unclinching. Removal and replacement techniques for axial, multilead and flat pack components are explained. The addition of components is also described. Repairs for lifted conductors and terminal areas, damaged conductor track and the replacement of terminal posts are included. Author (ESA)

N81-28370# National Bureau of Standards, Washington, D.C. Electron Devices Div.

SEMICONDUCTOR TECHNOLOGY FOR THE NON-TECHNOLOGIST

Robert I. Scace Jan. 1981 28 p

(PB81-166902; NBSIR-81-2197) Avail: NTIS HC A03/MF A01 CSCL 09A

The properties of semiconductor materials, the methods of processing them, and the solid state products made from them are described. Processing technology is discussed in detail, product development is considered, and diodes, transistors, thyristors, and integrated circuits are described. Cost, complexity, and applications trends are considered. J.D.H.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N81-28371*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNSTEADY NEWTON-BUSEMANN FLOW THEORY. PART 2: BODIES OF REVOLUTION

W. H. Hui and Murray Tobak (Waterloo Univ., Ontario) Apr. 1981 37 p refs Backup document for AIAA journal scheduled for publication in AIAA Journal, Oct. 1981

(NASA-TM-80459; LOG-J12130-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 20D

Newtonian flow theory for unsteady flow past oscillating bodies of revolution at very high Mach numbers is completed by adding a centrifugal force correction to the impact pressures. Exact formulas for the unsteady pressure and the stability derivatives are obtained in closed form and are applicable to bodies of revolution that have arbitrary shapes, arbitrary thicknesses, and either sharp or blunt noses. The centrifugal force correction arising from the curved trajectories followed by the fluid particles in unsteady flow cannot be neglected even for the case of a circular cone. With this correction, the present theory is in excellent agreement with experimental results for sharp cones and for cones with small nose bluntness; gives poor agreement with the results of experiments in air for bodies with moderate or large nose bluntness. The pitching motions of slender power-law bodies of revulution are shown to be always

dynamically stable according to Newton-Busemann theory.
A.R.H.

N81-28372 Washington Univ., Seattle.
A SIMPLE MODEL FOR TIME-DEPENDENT, STABLY STRATIFIED TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Charles Edward Long 1981 180 p
Avail: Univ. Microfilms Order No. 8113460

Time dependence and stable stratification of planetary boundary layer flows are investigated. A simple, one dimensional eddy coefficient model is developed for four neutrally stratified, time dependent flows. The mathematical form of the eddy coefficient is a function linear in distance from the boundary modulated by an exponential function which decays with distance from the boundary. The momentum transferring properties of boundary layer turbulence as represented by this form of the eddy coefficient are found to be not limited to planetary boundary layer flows. The effects of stable stratification on the mass and momentum transferring properties of the turbulence are deduced for flows with a quasi steady turbulence field. The capability of the model to predict momentum and stress fields in stably stratified flow is tested using data from three independent experiments.
Dissert. Abstr.

N81-28373 California Univ., Berkeley.
AN EXPERIMENTAL STUDY OF MASS SEPARATION IN OPPOSED JET FLOW Ph.D. Thesis
Wayne Thomas McDermott 1980 189 p
Avail: Univ. Microfilms Order No. 8113120

An experimental investigation into the processes leading to mass ration of mass disparate mixtures of argon and helium in a two dimensional opposed jet flowfield is discussed. An opposed jet flowfield utilizes centripetal acceleration resulting from curved streamlines to induce separation of the mixture components. The electron beam fluorescene Doppler shift and direct flow probe sampling tecniques are utilized to determine the species-specific velocity and composition characteristics. The results are presented in the form of velocity flowfields and characteristics stage separation factors and indicate stage separation factors competitive with those indicated for ideal barrier diffusion processses. The results also indicate an intrinsic self similar behavior of the transverse velocity and composition profiles of the merged flow in the immediate vicinity of the jet interaction region.
Dissert. Abstr.

N81-28374 California Univ., Berkeley.
BOUNDARY MIXING IN DENSITY-STRATIFIED FLUIDS Ph.D. Thesis
Gregory Neil Ivey 1980 136 p
Avail: Univ. Microfilms Order No. 8113080

A vertically oscillating grid, mounted flush with the vertical end wall of the experimental tank, is used to simulate boundary mixing. The experiment demonstrates that the ocillation of the grid creates a turbulent mixing region in its vicinity. Mixing within this region creates a step-like structure in an initially smooth profile of density with depth. These steps, in turn, drive multiple intrusions of mixed fluid away from the boundary and into the non-turbulent interior of the fluid. A compensating return flow carries fluid from the interior into the turbulent mixing region. Dye observations suggest that very little vertical mixing occurs in the interior as a result of the instrusions. The net vertical mass flux, which is both observed and measured in the experiment, is accompanied by a gradual change in the vertical density distribution (due to the water body's impermeable top and bottom boundaries). The resulting density changes are communicated to the interior by the instrusions. Thus there is little horizontal variation in the vertical density distribution in the water body.
Dissert. Abstr.

N81-28375 California Univ., Berkeley.
SOME FUNDAMENTAL PROBLEMS IN HEAT AND MASS TRANSFER THROUGH POROUS MEDIA Ph.D. Thesis
Kambiz Vafai 1980 100 p
Avail: Univ. Microfilms Order No. 8113219

An analytical investigation of the effective thermal conductivity of microsphere and fibrous insulation media was carried out. Because of the statistical nature of random packing patterns of microspheres and fibers, there exists a range of effective thermal conductivities for any given solid fraction of the microsphere or fibrous insulation medium. An analysis that applied two standard variational principles to some model media results in the statistical upper and lower bounds of the effective thermal conductivity. The physical models composed of cells with different packing configurations in case of microspheres and special fiber-matrix arrangements in case of fibrous insulation simplify the evaluation of the statistical bounds. The pertinent parameters for determining the effective conductivity are thermal conductivities of the constituent phases, the volume fraction, and a constant that is function of the cell geometry.
Dissert. Abstr.

N81-28376 California Univ., Berkeley.
THERMAL RADIATION IN FIBROUS INSULATIONS Ph.D. Thesis
Timothy Wai-Cheong Tong 1980 146 p
Avail: Univ. Microfilms Order No. 8113213

Models are developed to predict the radiant heat flux in the insulation. The basis problems involved are: radiation modeling and determination of the radiative properties of the insulation. The radiative properties, determined based on extinction of electromagnetic radiation, are used with the above models to predict the radiant energy transferred in LWFI. The mean radius of the fiber is the most influencing property on the ability of the insulation to restrict radiative heat transfer.
Dissert. Abstr.

N81-28377 California Univ., Berkeley.
AN EXPERIMENTAL INVESTIGATION OF THE INTERACTION BETWEEN A KARMAN VORTEX STREET AND A PREMIXED LAMINAR FLAME Ph.D. Thesis
Izak Namer 1980 111 p
Avail: Univ. Microfilms Order No. 8113145

The interaction of a premixed C2H4-air flame with a Karman vortex street was studied. Laser Doppler anemometry was used for velocity measurements and Rayleigh scattering was used to measure total gas density. A reference hot wire was used to enable phase-locked ensemble averaging to be performed on the data. The velocity measurements for vortex shedding cylinder Reynolds numbers indicated that the vortex street and, hence, the flow field upstream of the flame is deflected by the flame. This is due to the pressure drop across the flame which is necessary to accelerate the flow behind the flame. The vortices were not observed behind the flame. The combination of dilation and increased dissipation consumed the vortices. Density statistics obtained from Rayleigh scattering measurements were compared with predictions by the Bray-Moss-Libby (B-M-L) model which neglects intermediate states. Density fluctuations were overpredicted by the B-M-L model by a small amount.
Dissert. Abstr.

N81-28378 Minnesota Univ., Minneapolis.
MELTING OF A SOLID ADJACENT TO A HEATED VERTICAL CYLINDER WITH OR WITHOUT SUBCOOLING OF THE SOLID Ph.D. Thesis
Randall Gail Kemink 1981 265 p
Avail: Univ. Microfilms Order No. 8115006

Experiments were performed to provide quantitative heat transfer data corresponding to the problem of melting about a heated vertical cylinder embedded in a solid phase change material. The phase change material employed was 99 percent pure n-eicosane paraffin having an experimentally determined melting point of 36.4 C. Experiments were conducted with the solid phase either at the melting point or subcooled by 14.4 C. Measured transient cylinder wall temperatures demonstrate that the present melting problem is characterized by a conduction heat transfer regime at early times followed by a transition to a natural convection dominated regime. During the later stages of the natural convection regime, the cylinder wall temperatures reach a steady state condition. The steady state regime was defined to exist once the measured heat transfer coefficient had attained values within five percent of the final value. The correlations for the nonsubcooling tests are in good agreement with others corresponding to natural convection in vertical spaces. The correlations for the subcooling tests are not in good agreement indicating the presence of other participating transfer processes.
Dissert. Abstr.

N81-28379 Minnesota Univ., Minneapolis.
MATCHED EIGENFUNCTION EXPANSIONS FOR RHEOLOGICAL FLOWS Ph.D. Thesis
Steven Arman Trogdon 1981 200 p
Avail: Univ. Microfilms Order No. 8115054

The stick-slip problem for a fluid extruded from a round pipe is solved in two ways, obtaining the same result; by a Wiener-Hopf method and by a direct method. In the direct method eigenfunction solutions are matched on the common boundary between the fluid-filled pipe and the fluid-filled jet. The shape of the free surface for the low speed jet is computed by a perturbation technique, giving a good approximation for the swell of a low speed jet when surface tension is large, but failing completely when surface tension is small. A new stick slip problem is then defined and solved using matched eigenfunction expansions. This problem reduces to the original stick-slip problem when surface tension is large, and gives good results for the shape of the free surface when surface tension is small. The problem of plane, slow flow of a second order fluid over a rectangular slot is next solved by matching biorthogonal eigenfunction expansions in different regions of flow. The effect of the geometry of the slot on normal stress measurements at the bottom of the slot is examined. Dissert. Abstr.

N81-28380 State Univ. of New York at Stony Brook.
FREE CONVECTIVELY INDUCED AIR INTRUSION EFFECTS ON HEAT TRANSFER THROUGH POROUS INSULATION Ph.D. Thesis
Richard Jaung 1981 131 p
Avail: Univ. Microfilms Order No. 8113404

The thermal resistance of porous thermal insulation is investigated. A 4.0 ft. by 5.0 ft. double heat transfer gage test apparatus is employed to study the thermal performance of a sandwich-type insulator system quantitatively. Heat transfer through porous medium without free convectively induced air intrusion effects is also investigated. Boundary emissivity effects and cellularization effects are studied to understand the role of radiative heat transfer. Various arrangements of nonpermeable and semipermeable membranes were inserted at the air insulator interface to improve its performance. Incompressible fluid dynamic equations describing the convective flow are analyzed and approximated using finite difference methods. The thermal boundary layer is studied experimentally. Interferometric experimental results are qualitatively agreed with the numerical solutions. It is shown that the installation of interfacial barriers upgrade the thermal performance of sandwich insulation. Dissert. Abstr.

N81-28381 Wisconsin Univ. - Madison.
AN LDA STUDY OF VISCOELASTIC FLOW PAST A ROTATING CYLINDER Ph.D. Thesis
Richard Lee Christiansen 1980 259 p
Avail: Univ. Microfilms Order No. 8107021

The velocity field in low Reynolds number, steady state, two dimensional non-Newtonian flow transverse to a rotating circular cylinder was investigated with laser Doppler anemometry (LDA). The Doppler frequency was measured with a counter type signal processor interfaced to a digital computer. A flow visualization technique was combined with the velocity data to resolve the directional ambiguity of the LDA system. Velocity data were obtained for three separate fluids: 90% glycerin, 0.5% Separan AP-30 (polyacrylamide) in water, and 1.0% CELLOSIZE hydroxyethyl cellulose in water. Based on measurements of the viscosity and the first normal stress difference, the time constant of the aqueous polyacrylamide solution was 8.3 s and 0.041 s for the hydroxyethyl cellulose solution. The Reynolds number ranged from 0.03 to 0.5 and the Deborah number ranged from 0.3 to 150. Although most of the velocity measurements were at locations within nine radii of the center of the cylinder, some measurements were made as far as 24 radii downstream.
Dissert. Abstr.

N81-28382 California Univ., Berkeley.
MIXING AND FLOODING IN VERTICAL GAS-LIQUID COUNTERCURRENT FLOW THROUGH PARALLEL PATHS Ph.D. Thesis
Chun-Peng Liu 1980 231 p
Avail: Univ. Microfilms Order No. 8113111

A series of experiments were performed to characterize the onset of mixing in multiple path flow. Multiple path flow possesses mixing characteristics similar to those for single channel flow and the resulting flow rate pairs can be correlated by the Wallis and the Wallis-Kutateladze correlation. In addition, there is some secondary behavior unique to the multiple path flow. The path inlet configuration and path surface roughness both have a significant influence on the onset of mixing. A modeling procedure was developed to analyze the onset of mixing, and produced algebraic solutions which are in qualitative agreement with the actual testing results. Based on the analysis, the Wallis and the Wallis-Kutateladze correlation may be interpreted as a dynamic similarity condition for the occurrence of certain events in a two phase countercurrent flow system. However, the parametric dependence of the dynamic similarity condition was shown to be considerably more complicated than that indicated by the Wallis and the Wallis-Kutateladze correlation. Dissert. Abstr.

N81-28383 California Univ., Berkeley.
LAMINAR NATURAL CONVECTION IN RECTANGULAR ENCLOSURES Ph.D. Thesis
Gautam Shrinath Shiralkar 1980 131 p
Avail: Univ. Microfilms Order No. 8113188

A computer code (FIRE) capable of numerically simulating steady laminar flow due to buoyancy effects within rectangular enclosures is developed. This code combines the unconditional stability of the exponential differencing scheme (EDS) with the economy of a variable grid formulation, and also the false transient method with the alternating direction implicit (ADI) procedure, so as to obtain accurate solutions at reasonable cost. FIRE is used to investigate two different problems. The first is a numerical investigation of free convective flow in shallow enclosures, for the case of moderate as well as low Prandtl numbers. The second problem is a numerical investigation of buoyant flow within a square enclosure subjected to both horizontal and vertical temperature differentials. The third problem is an analytical study of the high Rayleigh number regime in shallow enclosures, characterized by laminar boundary layers lining all four walls.
Dissert. Abstr.

N81-28384 California Univ., Santa Barbara.
LIQUID VISCOSITIES OF MULTI-COMPONENT MIXTURES Ph.D. Thesis
Manuchehr Dizechi 1980 230 p
Avail: Univ. Microfilms Order No. 8114219

McAllister's theory of viscosity of liquid mixtures was modified in order to account for temperature dependencies different than that predicted by the Eyring model. By means of an Antoine type equation and restricting the interactions to three-bodied interactions in the single plane a more valid correlation technique was established for predicting the viscosities of the binary, ternary, and multi-component liquid mixtures. The resulting equation was tested with the experimentally obtained viscosity data of 41 binary and 16 ternary mixtures containing polar as well as nonpolar components. The improved version of the McAllister equation appears to be suited to represent viscosity data of binary and ternary mixtures than other equations that may be found in the literature. Dissert. Abstr.

N81-28385 Colorado Univ. at Boulder.
MEASUREMENT AND CALCULATION OF PROPERTIES OF GAS-SOLID TWO-PHASE JETS Ph.D. Thesis
Koichi Hayashi 1980 334 p
Avail: Univ. Microfilms Order No. 8113965

An optical technique was developed to measure particle concentration profiles in a two phase axisymmetric jet. The steady state mean gas velocity profiles of the single phase and two phase jets were measured by a pitot tube. Particle size distribution across the jet was measured with isokinetic particle sampling probes. Schlieren photographs of shock waves in the jet were taken to study the influence of particles on shock wave structure near the exit of the nozzle. The steady state mean gas phase temperature profiles of the single phase and two phase jets were measured by a thermocouple. The effect of the nozzle configurations on the two phase jet flow was also studied. The measurements were made by seeding 1, 3, and 5% by weight of 1 and 83.6 micrometer mean diameter alumina particles and 24 micrometer mean diameter spherical fly ash particles into jets at Mach numbers of 0.2, 0.8, 1.0, and 1.17. Dissert. Abstr.

N81-28386 Duke Univ., Durham, N. C.
MEASUREMENT OF NONSTATIONARY TURBULENT FLOW IN A TIDAL CHANNEL BY LASER DOPPLER VELOCIMETRY Ph.D. Thesis
John Thomas McMurray 1980 261 p
Avail: Univ. Microfilms Order No. 8114555

A statistical description of longitudinal velocity and temperature fluctuations in a high Reynolds number geophysical flow was obtained using a unique submersible laser Doppler velocimeter to measure the instantaneous fluid velocity, and a thermistor to measure fluid temperature. One point probability densities were computed for all phases of the tidal cycle for both velocity and temperature. Periods of steady mean velocity were found to occur during the peak velocity periods. The turbulence is nonstationary in these steady segments as well as in all other phases of the tidal cycle. Measurements of mean velocity, mean square velocity fluctuations, skewness, and flatness factor are presented. The average skewness is negative for all phases of the tidal flow and the average flatness factor is approximately 3.0. Measured probability densities of temperature fluctuations indicate the presence of temperature intermittency in the tidal flow. Autocorrelation functions were also computed during all phases of the tidal cycle for both velocity and temperature.
Dissert. Abstr.

N81-28387 Oklahoma State Univ., Stillwater.
PRESSURE DROP IN TWO-PHASE FLOW Ph.D. Thesis
Saedeldeen Ahmad Akashah 1980 92 p
Avail: Univ. Microfilms Order No. 8113289

A computer program was developed containing some of the methods for predicting pressure drop in two-phase flow. The program contains accurate methods for predicting phase behavior and physical properties and can be used to calculate pressure drops for horizontal, inclined and vertical phases. The program was used to solve test cases for many types of flow, varying the diameter, roughness, composition, overall heat transfer coefficient, angle of inclination, and length. The Lockhart-Martinelli correlation predicts the highest pressure drop while the Beggs and Brill method predicts the lowest. The American Gas Association-American Petroleum Institute method is consistent and proved to be reliable in vertical, horizontal and inclined flow. The roughness of the pipe diameter had great effect on pressure drop in two-phase flow, while the overall heat transfer coefficient had little effect.
Dissert. Abstr.

N81-28388 Purdue Univ., Lafayette, Ind.
STAGNATION REGION GAS FILM COOLING: SPANWISE ANGLED INJECTION FROM MULTIPLE ROWS OF HOLES Ph.D. Thesis
David Wilson Luckey 1980 407 p
Avail: Univ. Microfilms Order No. 8113718

The film cooling performance was modeled for a turbine vane leading edge using the stagnation region of a cylinder in cross-flow. Experiments were conducted in a rectangular duct using a cylindrical test surface. A gas turbine combustor provided heated air flow to simulate the Reynolds number and internal convection cooling of the cylinder allowed the freestream-to-wall temperature of 1.7 to be achieved. The film coolant injected at room temperature, passed through angled coolant holes. The cylindrical test surface was instrumented with miniature heat flux gages and wall thermocouples to determine the percentage reduction in the Stanton number as a function of the distance downstream of injection and the location between adjacent holes. Data from local heat flux measurements are presented for single row and multiple row injection configurations.
Dissert. Abstr.

N81-28389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPRESSURIZATION AND TWO-PHASE FLOW OF WATER CONTAINING HIGH LEVELS OF DISSOLVED NITROGEN GAS
Robert J. Simoneau Jul. 1981 46 p refs
(NASA-TP-1839; E-216) Avail: NTIS HC A03/MF A01 CSCL 20D

Depressurization of water containing various concentrations of dissolved nitrogen gas was studied. In a nonflow depressurization experiment, water with very high nitrogen content was depressurized at rates from 0.09 to 0.50 MPa per second and a metastable behavior which was a strong function of the depressurization rate was observed. Flow experiments were performed in an axisymmetric, converging diverging nozzle, a two dimensional, converging nozzle with glass sidewalls, and a sharp edge orifice. The converging diverging nozzle exhibited choked flow behavior even at nitrogen concentration levels as low as 4 percent of the saturation level. The flow rates were independent of concentration level. Flow in the two dimensional, converging, visual nozzle appeared to have a sufficient pressure drop at the throat to cause nitrogen to come out of solution, but choking occurred further downstream. The orifice flow motion pictures showed considerable oscillation downstream of the orifice and parallel to the flow. Nitrogen bubbles appeared in the flow at back pressures as high as 3.28 MPa, and the level at which bubbles were no longer visible was a function of nitrogen concentration.
E.A.K.

N81-28390*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERFORMANCE AND ANALYSIS OF A THREE-DIMENSIONAL NONORTHOGONAL LASER DOPPLER ANEMOMETER
Philip K. Snyder, Kenneth L. Orloff, and Kiyoshi Aoyagi Jul. 1981 42 p refs
(NASA-TM-81283; A-8629) Avail: NTIS HC A03/MF A01 CSCL 20D

A three dimensional laser Doppler anemometer with a nonorthogonal third axis coupled by 14 deg was designed and tested. A highly three dimensional flow field of a jet in a crossflow was surveyed to test the three dimensional capability of the instrument. Sample data are presented demonstrating the ability of the 3D LDA to resolve three orthogonal velocity components. Modifications to the optics, signal processing electronics, and data reduction methods are suggested.
E.A.K.

N81-28391*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF BOUNDARY-LAYER CHARACTERISTICS OF AN OSCILLATING AIRFOIL
Tuncer Cebeci (Calif. State Univ. at Long Beach) and Lawrence W. Carr Jul. 1981 17 p refs
(NASA-TM-81303; A-8639; USAAVRADCOM-TR-81-B-18)
Avail: NTIS HC A02/MF A01 CSCL 20D

The evolution of unsteady boundary layers on oscillating airfoils is investigated by solving the governing equations by the Characteristic Box scheme. The difficulties associated with computing the first profile on a given time line, and the velocity profiles with partial flow reversal are solved. A sample calculation is performed for an external velocity distribution typical of those found near the leading edge of thin airfoils. The viability of the calculation procedure is demonstrated.
Author

N81-28392*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMIC BEHAVIOR OF AN UNSTEADY TRUBULENT BOUNDARY LAYER
P. G. Parikh, W. C. Reynolds, R. Jayaramen, and L. W. Carr Jul. 1981 14 p refs Prepared in cooperation with Stanford Univ., Calif.
(NASA-TM-81304; A-8640; USAAVRADCOM-TR-81-B-17; Rept-992-21-01) Avail: NTIS HC A02/MF A01 CSCL 20D

Experiments on an unsteady turbulent boundary layer are reported in which the upstream portion of the flow is steady (in the mean) and in the downstream region, the boundary layer sees a linearly decreasing free stream velocity. This velocity gradient oscillates in time, at frequencies ranging from zero to approximately the bursting frequency. For the small amplitude, the mean velocity and mean turbulence intensity profiles are unaffected by the oscillations. The amplitude of the periodic velocity component, although as much as 70% greater than that in the free tream for very low frequencies, becomes equal to that in the free stream at higher frequencies. At high frequencies, both the boundary layer thickness and the Reynolds stress distribution across the boundary layer become frozen. The behavior at higher amplitude is quite similar. At sufficiently high frequencies, the boundary layer thickness remains frozen at the mean value

over the oscillation cycle, even though flow reverses near the wall during a part of the cycle. A.R.H.

N81-28393# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THERMAL RESISTANCE OF A CONVECTIVELY COOLED PLATE WITH APPLIED HEAT FLUX AND VARIABLE INTERNAL HEAT GENERATION

Nellore S. Venkataraman, Humberto Pontes Cardoso, and Olavo Bueno deOliveira Filho May 1981 14 p refs Proposed for presentation at the 6th Congr. Brasileiro de Eng. Mecan., Rio de Janeiro, 15-18 Dec. 1981

(INPE-2079-RPE/314) Avail: NTIS HC A02/MF A01

The conductive heat transfer in a rectangular plate with nonuniform internal heat generation, with one end convectively cooled and a part of the opposite end subjected to external heat flux, is considered. The remaining part of this end as well as the other two sides are thermally insulated. The governing differential equation is solved by a finite difference scheme. The variation of the thermal resistance with Biot modulus, the plate geometry, the internal heat generation parameter and the type of profile of internal heat generation are discussed. Author

N81-28394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTERPLANETARY MAGNETIC CLOUDS AT 1 AU

L. W. Klein (Computer Sciences Corp., Silver Spring, Md.) and L. F. Burlaga Apr. 1981 32 p refs Submitted for publication (NASA-TM-82114) Avail: NTIS HC A03/MF A01 CSCL 20D

Magnetic clouds are defined as regions with a radial dimension approximately 0.25 AU (at 1 AU) in which the magnetic field strength is high and the magnetic field direction changes appreciably by means of rotation of one component of B nearly parallel to a plane. The magnetic field geometry in such a magnetic cloud is consistent with that of a magnetic loop, but it cannot be determined uniquely. Forty-five clouds were identified in interplanetary data obtained near Earth between 1967 and 1978; at least one cloud passed the Earth every three months. Three classes of clouds were identified, corresponding to the association of a cloud with a shock, a stream interface, or a CME. There are approximately equal numbers of clouds in each class, and the three types of clouds might be different manifestations of a coronal transient. The magnetic pressure inside the clouds is higher than the ion pressure and the sum is higher than the pressure of the material outside of the cloud. A.R.H.

N81-28395# Texas Technological Univ., Lubbock. Dept. of Mechanical Engineering.

LAMINAR OR TURBULENT FLOW IA A 2-D OR AXISYMMETRIC BIFURCATED CHANNEL USING A BODY FITTED COORDINATED SYSTEM

Allen Goldman 15 Aug. 1980 46 p refs Backup document for AIAA synoptic scheduled for publication in AIAA Journal, Sep. 1981

(LOG-J12172) Avail: NTIS HC A03/MF A01 CSCL 20D

Body fitted coordinate techniques were used in conjunction with standard finite difference techniques to calculate the flow in the channel. The geometry could be either two-dimensional or axisymmetric and the flow could be either laminar or turbulent, with a two equation eddy viscosity model used for evaluating the Reynolds stresses. Solutions were obtained for a range of Reynolds numbers of 1350 to 750,000. It was found that the first order terms generated by the transformation process and those generated from the Reynolds stresses must be individually upwind differenced to obtain a converged solution. The transformation process generates scale factors which are used in all calculations; this generates the need for large core storage or offline storage with large input/output times. T.M.

N81-28396*# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENT FLOW IN A SQUARE-TO-ROUND TRANSITION Final Report

A. M. K. P. Taylor, J. H. Whitelaw, and M. Yianneskis Washington NASA Jul. 1981 20 p refs

(Contract NASw-3258)

(NASA-CR-3447; FS/80/30) Avail: NTIS HC A02/MF A01 CSCL 20D

Measurements of turbulent flow in a duct with a cross sectional transition from square to round are presented. Laser Doppler velocimetry was used to measure the mean velocity components, turbulence levels and shear stresses. The boundary layers at the inlet and exit of the transition were approximately 13 percent and 20 percent of the hydraulic diameter respectively, becoming thicker near the corner fillets. The development of secondary flow, of magnitudes up to 7 percent of the bulk velocity is shown. This flow is directed away from the corner fillets and along the periphery of the duct and is associated with the longitudinal curvature of the wall and the related pressure gradients. Author

N81-28397# Queensland Univ., St. Lucia (Australia).

SHAPE EFFECTS ON RESISTANCE TO FLOW IN SMOOTH RECTANGULAR CHANNELS

A. K. Kazemipour Apr. 1980 26 p refs

(RR-CE-9) Avail: NTIS HC A03/MF A01

The effectiveness and generality of Kazemipour's method for dealing with the effects of cross sectional shape on flow resistance in open channels was investigated for the case of smooth rectangular channels. The chamber used for the experiment and procedures for establishing uniform flow and normal depth are described. Kazemipour's method shifts the experimental resistance data for flow in smooth channels onto the universal diagrams for smooth circular pipes. The shape factor establishes a simple correlation between tha flow in circular pipes and open channels and permits the friction factor and the average velocity of the flow in the channel to be calculated from the universal resistance formulae and diagrams for circular pipes. Results verify that the two new parameters Kazemipour introduces are more representative than those used by other investigators and offer solutions more rational than those previously proposed. A.R.H.

N81-28398# Queensland Univ., St. Lucia (Australia). Dept. of Civil Engineering.

RESISTANCE OF FLOW IN IRREGULAR CHANNELS

A. K. Kazemipour and C. J. Apelt Feb. 1980 29 p refs

(RR-CE-7) Avail: NTIS HC A03/MF A01

Two sets of experiments are described which were designed to clarify some aspects of resistance to flow in irregular channels and to separate losses due to boundary shear from those caused by irregularities in the flow cross section (form losses). It is demonstrated that a certain type of irregularity, in which the flow cross section remains constant or nearly so, does not produce any form loss. This type of irregularity is the one in which any change in the width of the channel is associated with any a change in the elevation of the channel bed (change in depth of flow), such that the flow cross section remains the same, or nearly so, through the irregularity. Other types of irregularities associated with rapid changes in flow cross section, in which the flow cross section does not remain constant through the irregularity, produced form losses which accounted for up to 92 percent of the total loss in the channel. The unsoundness of using Manning's 'n' is discussed. A.R.H.

N81-28399# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

THE INTERACTION OF AN INCIDENT WAVE FIELD WITH A FLOATING SLENDER BODY AT ZERO SPEED

P. D. Sclavounos [1981] 17 p refs Sponsored in part by the Navy and NSF

Avail: NTIS HC A02/MF A01

A linear slender body theory is presented for the zero speed motions of a ship in regular free surface waves, valid for an arbitrary angle of incidence and all wavelengths of practical interest. The velocity potential of the 'radiation' problem is obtained by the superposition of a particular solution, identical to that of the short wavelength strip theory, and a homogeneous component that accounts for the longitudinal flow interactions. A similar representation is used for the 'diffraction' problem where the particular solution is equal and opposite to the incident wave velocity potential. Computations are presented for the vertical hydrodynamic force distribution and the heave and pitch added mass and damping coefficients, exciting forces and motions for a Series 60 hull. Comparisons are made with strip theory, a three dimensional theory and experiments. Author

N81-28400# Indian Inst. of Tech., Bombay. Dept. of Mathematics.

A CRITICAL STUDY OF POISEUILLE FLOW OF COUPLE STRESS FLUID WITH APPLICATIONS TO BLOOD FLOW

P. Chaturani and V. P. Rathod [1981] 10 p refs Sponsored by CSIR

Copyright. Avail: NTIS HC A02/MF A01

It is shown that the method used for comparing theoretical and experimental results is erroneous and the values of the couple stress parameters obtained for blood flow are incorrect. A method for determining the couple stress parameters is presented. The computational work in the improved method is considerably less. It is observed that both the couple stress parameters are functions of concentration. An empirical relation between concentration and the stress parameters is obtained. The shear viscosity and non-dimensional axial velocity are functions of concentration. Some uses of determining the values of the couple stress parameters are suggested. J.D.H.

N81-28401# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

NONLINEAR VISCOELASTIC BREAKUP IN A HIGH-VELOCITY AIRSTREAM Technical Report, May 1979 - Apr. 1980

Joseph E. Matta Mar. 1981 28 p refs

(DA Proj. 1L1-62706-A-553)

(AD-A100263; AD-E410398; ARCSL-TR-80067) Avail: NTIS HC A03/MF A01 CSCL 20/4

Weiss and Worsham's predictions for atomization in high-velocity airstreams appear valid even when extended to higher viscosity fluids than originally derived. Newtonian, and viscoelastic fluids show different breakup mechanisms in high-velocity airstreams, as shown by injection photos, mass median diameters and drop-size distributions. Although not because of increase in viscosity alone, addition of polymer increases resultant particle size from liquids. For a given polymer, mass median diameter (MMD) versus lambda correlation derived from Weber style analysis (using the conjectural elongational viscosity model) predicts performance when concentration is varied. The first normal stress difference measured for viscoelastic solutions correlated well with their dissemination performance MMD. GRA

N81-28402# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A COMPARISON OF VARIOUS TECHNIQUES FOR THE PREDICTION OF MASS-LOADED MODE SHAPES AND NATURAL FREQUENCIES M.S. Thesis

Frank Broderick Atkinson Mar. 1981 134 p refs

(AD-A100820; AFIT/GAE/AA/80D-1) Avail: NTIS HC A07/MF A01 CSCL 12/1

The purpose of this investigation was to compare the results obtained from three modal prediction techniques. The first technique was an algorithm developed by Whaley for lightly damped structures (Method 1). Results using this algorithm were extracted from a thesis by Glenesk. The second method was the finite element method using NASTRAN (Method 2). The final method was the recovery of unloaded mass and stiffness matrices from the general matrix-vector differential equation of modal analysis using modal data obtained from an unloaded test item (Method 3). GRA

N81-28403# Los Alamos Scientific Lab., N. Mex.

HYDROX: A ONE-DEMENSIONAL LAGRANGIAN HYDRODYNAMICS CODE

M. S. Shaw Mar. 1981 358 p

(Contract W-7405-eng-36)

(LA-8642-M) Avail: NTIS HC A16/MF A01

The HYDROX is a one dimensional Lagrangian hydrodynamics computer code written in FORTRAN for the solution of problems with plane, cylindrical, or spherical symmetry. A user may request automatic problem zoning, rezoning, and automatic time step controls. Equation of state libraries for HOM and SESAME are available. Input to HYDROX is by way of NAMELIST and output may be sent to several different disk files, including a file that is directly readable by the interactive graphics code GAS. A restart capability is also provided. DOE

N81-28404# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

WATER FLOWS FROM SLOTTED PIPES

D. A. Olson Apr. 1981 43 p refs

(Contract DE-AC02-77CH-00178)

(SERI/TR-631-984) Avail: NTIS HC A03/MF A01

Results of experiments and analyses that determine jet flow distribution from slotted pipes of dimensions typical for OC-OTEC evaporators or condensers are described. For a pipe with a 6.3 cm inside diameter and 0.64 cm wide slot, the measured and predicted jet flow was low and nearly parallel to the pipe at the entrance, and high and perpendicular to the pipe only near the closed end. Slot lengths ranged from 1.5 m to 4.6 m, and inlet flow rates varied from 6 kg/s to 17 kg/s. Friction reduces the pressure in the entrance and intermediate portions of the pipe, while the rapidly decelerating flow produces high pressure recovery as it approaches the closed end. In the region of high flow next to the closed end, the ratio of slot area (slot length times width) to pipe cross sectional area is less than two. To use a slotted pipe for generating falling jets in an OC-OTEC plant, the slot length should be 1 m or less (for a pipe with a 6.3-cm inside diameter and a 0.64-cm wide slot). DOE

N81-28405# Oak Ridge National Lab., Tenn. Nuclear Div.

TWO-PHASE-FLOW VELOCITY MEASUREMENT USING TWO FULL FLOW DRAG BODIES AS TRANSIT TIME FLOWMETERS

Charles F. Davis 1981 12 p refs Presented at the 2nd Intern. Symp. on Flow, St. Louis, 6-10 Apr. 1981

(Contract W-7405-eng-26)

(CONF-810434-1) Avail: NTIS HC A02/MF A01

The experimental determination and the interpretation of the time interval for the passage of a flow disturbance between two points, and the interpretation of the velocity once it has been calculated, are investigated. Two drag flowmeters were tested in vertical two phase air/water flow. Three different configurations were studied: in the first a drag body was placed 15.2 cm downstream of the other, in the second, the separation was 29.2 cm, and in the third the separation was 62.2 cm. DOE

N81-28406# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.

APPLICATION OF A VORTEX SHEDDING FLOWMETER TO THE WIDE RANGE MEASUREMENT OF HIGH TEMPERATURE GAS FLOW

S. P. Baker, R. M. Ennis, Jr. (TRW, Inc.), and P. G. Herndon 1981 21 p refs Presented at the 2nd Intern. Symp. on Flow, St. Louis, 6 Apr. 1981

(Contract W-7405-eng-26)

(CONF-810434-3) Avail: NTIS HC A02/MF A01

A flowmeter for helium gas measurement in a Gas Cooled Fast Breeder Reactor loss of coolant simulation is described. A vortex shedding flowmeter was selected and specially modified to provide for a remoted thermal sensor. Experiments to determine the relationship between signal attenuation and sensor remoting geometry, as well as the relationship between gas flow parameters and remoted thermal sensor signal for both compressed air and helium gas were conducted, and the sensor remoting geometry optimized for this application. The associated temperature increase at the sensor position was 9 C above ambient (25 F) at a flowing temerature of 350 C. The volumetric flow accuracy was measured over the entire 155:1 flow range at parametric values of flowing density. A volumetric flow accuracy of + -, percent of reading was demonstrated. DOE

N81-28407# Knolls Atomic Power Lab., Schenectady, N. Y.

DISCRETE-PRESSURE EQUATIONS IN INCOMPRESSIBLE-FLOW PROBLEMS

E. L. Wachspress Jan. 1981 18 p refs Presented at IIMAS Workshop on Numerical Analysis, Mexico City, 12 Jan. 1981

(Contract DE-AC12-76SN-00052)

(KAPL-4139; TID-4500-R66) Avail: NTIS HC A02/MF A01

It is demonstrated that consistent integration of flow divergence and pressure gradient terms over interlocking mesh boxes preserves properties that enhance stability and convergence of discretized Navier-Stokes equations over regions partitioned with isoperimetric quadrilaterals. DOE

N81-28408# California Univ., Livermore. Lawrence Livermore Lab.

OPTIMIZING THE HEAT PIPE FOR OPERATION IN A MAGNETIC FIELD WHEN LIQUID-METAL WORKING FLUIDS ARE USED

R. W. Werner and M. A. Hoffman 18 May 1981 9 p refs (Contract W-7405-eng-48)

(UCID-19049) Avail: NTIS HC A02/MF A01

A method for reducing magnetohydrodynamic (MHD) pressure drops in the liquid metal flow in a heat pipe wick is described. By flattening the heat pipe, the eddy current return path in the metallic heat pipe wall is increased significantly, thereby increasing the effective wall resistance. This, in turn, reduces the magnitude of the MHD pressure drop. The same principle can also be applied to flows of liquid metal coolants in a magnetic field.

DOE

N81-28409# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

THE NUMERICAL PREDICTION OF FLOW AND HEAT TRANSFER IN ROD-BUNDLE GEOMETRIES Ph.D. Thesis - London Univ.

V. Ramachandra Aug. 1979 270 p refs Sponsored by London Univ.

(HTS/79/7) Avail: NTIS HC A12/MF A01

The parabolic partial differential equations which govern the three dimensional steady flow through an interior subchannel of a bare rod bundle were solved by means of a finite difference procedure. A special nonorthogonal coordinate system which represents the irregular geometry of the flow system was developed. The turbulence was represented by way of transport equations for the mean turbulent kinetic energy and its rate of dissipation. An algebraic formulation for the Reynold stresses in the cross stream plane of the channel was used to predict the nature and influence of the secondary flow field. Flow and heat transfer phenomena were studied under both laminar and turbulent conditions. The approach was extended to the computation of the flow behavior in equilateral triangular ducts. Local distribution and overall flow parameters were predicted over a wide range of rod spacings. Detailed comparison of the results obtained with experimental data shows in general good agreements. Author (ESA)

N81-28410# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

AN APPROACH TO CALCULATING TURBULENT FLOWS IN THE NEAR-WALL REGION

D. B. Spalding and M. A. Elhadidy Aug. 1979 39 p refs

(HTS/79/9) Avail: NTIS HC A03/MF A01

A one equation turbulent kinetic energy model which accounts for the low Reynolds number effect is used with a specified length scale to calculate turbulent transport in the near wall region. Outside this region a two equation turbulence model is employed. The procedure is used to predict turbulent flow in a pipe with heat transfer and can be used for more complicated flows. An iteration procedure was introduced to decrease the large number of grid points otherwise required for such work. The hydrodynamic and heat transfer results for the whole range of laminar Prandtl number fluids are in good agreement with experimental data. Author (ESA)

N81-28411# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

ONE DIMENSIONAL TWO-PHASE FLOW, WITH UNEQUAL VELOCITIES

D. Brian Spalding Oct. 1979 16 p refs Presented at EPRI Workshop on Two-Phase Flow Modeling in Reactor Safety, Tampa, Fla., 28 Feb. - 2 Mar. 1979

(HTS/79/10) Avail: NTIS HC A02/MF A01

A one dimensional transient analysis of an idealized steam generator is performed to show the ease with which the equations can be solved numerically if an appropriate procedure is employed. An interphase slip algorithm (IPSA) is described which is the generalization to many phases of a semi-implicit method for pressure linked equations. Illustrative problem parameters are given, including both fixed down-comer height and variable height conditions. The results of the computation are presented in terms of the volume fraction of vapor within the steam generator plotted against height for various times after start. The IPSA procedure is useful when solving the finite difference versions of the partial differential equation of two phase continuity and momentum. It can also be employed for two and three-dimensional problems.

Author (ESA)

N81-28412# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

THE STREAM-FUNCTION COORDINATE SYSTEM FOR SOLUTION OF UNSTEADY-COMPRESSIBLE-FLOW PROBLEMS

Kandadai Srinivasan Dec. 1979 105 p refs Sponsored by Combustion Heat and Mass Transfer Ltd.

(HTS/79/13) Avail: NTIS HC A06/MF A01

A computer program which solves two dimensional parabolic flow problems was adapted to solve one dimensional compressible flow problems which involve solution of hyperbolic equations. The governing differential equations are formulated in a sNeam function coordinate system. Implicit finite difference equivalents of these equations are solved by use of this computer program. The advantages of using a floating grid system are demonstrated by solving two problems: (1) the sudden stopping of steady flow, and (2) the shock tube. The physical realism and numerical accuracy of predictions are also discussed. It is observed that this method predicts a flow field which matches the exact solution fairly well. A notable feature of this procedure is its ability to locate the discontinuities in the temperature and density profiles. Author (ESA)

N81-28413# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

NUMERICAL MODELING OF FLOWS WITH MOVING INTERFACES Ph.D. Thesis

A. G. Àwn May 1979 345 p refs Sponsored by Concentration, Heat and Momentum (CHAM) Ltd., British Leyland and UK Science Research Council

(HTS/79/16) Avail: NTIS HC A15/MF A01

The elliptic differential equations are linearized by means of finite difference approximations and the resulting equations are solved by a fully implicit iterative method. The interface behavior was investigated by way of a Lagrangian technique. The computation scheme included the use of the volumetric form of the continuity equation in the calculation of compressible flow and the treatment of combustion by the setting of burning velocity and density ratio. The accuracy is found good for various one dimensional problems. The predicted flow patterns of several two dimensional flows which arise within internal combustion engine chambers were compared with experimental data. Satisfactory agreement is shown. An experiment was performed in order to investigate the propagation of a laminar flame in a vertical open tube. In general, the predictions are in satisfactory agreement with the experimental data. However, the accuracy of the predictions with regard to the flame shape requires further improvement. Author (ESA)

N81-28414# Technische Hogeschool, Delft (Netherlands). Lab. for Aero-and Hydrodynamics.

ON THE NUMERICAL SOLUTION TO THE INTEGRAL EQUATION FOR THE CALCULATION OF THE FLOW OF AN INCOMPRESSIBLE FLUID THROUGH A RECTILINEAR CASCADE OF THICK HIGHLY CAMBERED PROFILES, USING THE METHOD OF SINGULARITIES

A. J. Korff Jan. 1981 49 p refs

(WTHD-129) Avail: NTIS HC A03/MF A01

A method for determining the velocity distribution along a thick, highly cambered airfoil in a rectilinear cascade in an incompressible potential flow is presented. The basis of the calculations is Imbach's integral equation, a method of singularities. Furthermore, the condition is set that the drag of an airfoil should be zero. The method is applied to the so-called 'ETH' profile as indicated in Roeder's dissertation. The velocity distribution thus calculated appears to match very well the measured distribution along the whole profile contour, the trailing edge region included. Author (ESA)

N81-28415# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

NOTES ON THE UNSTEADY RECTILINEAR MOTION OF A

PERFECT GAS. PART 4: SOME STUDIES ON CENTERED RAREFACTION WAVES
J. A. Steketee Oct. 1979 62 p refs
(VTH-LR-284-Pt-4) Avail: NTIS HC A04/MF A01

A class of solutions for the equations of the unsteady, rectilinear motion of a perfect gas is constructed. The velocity is prescribed to be of the form u = A (x/t) + C. The homentropic, centered simple waves of the classical theory are included together with the homogeneous solutions of the Lagrangian equations of motion. Several more general flows are also obtained, i.e., among others the so-called Von Mises solutions. The generalizations admitted eliminate a difficulty found in the homogeneous solutions of the Lagrangian equations of motion when two different homogeneous flows are matched along a common particle path (jumps appear in temperature, density and entropy). By matching a homogeneous flow with a generalized flow no discontinuities in the parameters appear. Several details of the special cases included in the family are discussed, and it is pointed out that the family of solutions constructed has already been treated as the decay of a plane shock wave. Author (ESA)

N81-28416# Technische Hogeschool, Delft (Netherlands). Lab. for Aero- and Hydrodynamics.
ON THE INCOMPLETENESS OF THE NUMBER OF PHYSICAL PARAMETERS OF A FREE STREAMLINE POTENTIAL FLOW PROBLEM
J. vanderZanden Nov. 1980 15 p refs Submitted for publication
(WTHD-121) Avail: NTIS HC A02/MF A01

The two dimensional free streamline problem of a rectangular plate perpendicular to the jet flow from a nozzle is solved numerically. Earlier theoretical discussions of this problem mention only three physical parameters. It is shown that this number must be equal to that of the independent geometrical parameters of the problem, which is four, otherwise the problem is not well posed. A fourth parameter is introduced. Numerical integration is preferred, although analytical integration is, in principle, possible. The determination of parameters and streamlines depends on the solution of nonlinear equations with inequality constraints. Author (ESA)

N81-28417# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
OSCILLATORY FLOW AROUND DISCS AND THROUGH ORIFICES
B. deBernardinis, J. M. R. Graham, and K. H. Parker Nov. 1980 43 p refs
(IC-Aero-80-02; ISSN-0308-7247) Avail: NTIS HC A03/MF A01

Examples of unsteady, axisymmetric, separated flows are modeled, including unbounded oscillatory flow around a disk and bounded oscillatory flow through a sharp-edged orifice. Calculations are made, assuming that the flow is inviscid and that the shed vortex sheets can be represented by sequences of discrete vortex rings. The solid bodies, i.e., the disk or the orifice and bounding tube, are also represented by a distribution of bound discrete vortex rings whose strenghts are chosen to satisfy the Neumann or zero normal velocity boundary condition. The results of flow visualization experiments and, for the orifice, pressure drop measurements are reported. In general, the gross properties of the flows are predicted accurately. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-28418*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FOUR BAND DIFFERENTIAL RADIOMETER FOR MONITORING LNG VAPORS Final Report, Dec. 1978 - Jun. 1981
J. J. Simmonds 26 Jun. 1981 35 p refs
(MIPR-Z-70099-8-822868A)
(NASA-CR-164637; JPL-PUB-81-56) Avail: NTIS HC A03/MF A01 CSCL 14B

The development by JPL of a four band differential radiometer (FBDR) which is capable of providing a fast rate of response, accurate measurements of methane, ethane, and propane concentrations on the periphery of a dispersing LNG cloud. The FBDR is a small, low power, lightweight, portable instrument system that uses differential absorption of near infrared radiation by the LNG cloud as a technique for the determination of concentration of the three gases as the LNG cloud passes the instrument position. Instrument design and data analysis approaches are described. The data obtained from the FBDR prototype instrument system deployed in an instrument array during two 40 cubic meter spill tests are discussed. A.R.H.

N81-28419*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
PROTOTYPE Ge:Ga DETECTORS FOR THE NASA-AMES COOLED GRATING SPECTROMETER Final Technical Report, 1 May 1980 - 31 Jan. 1981
J. R. Houck Jul. 1981 12 p
(Contract NCC2-79)
(NASA-CR-164639) Avail: NTIS HC A02/MF A01 CSCL 14B

The detectors were fabricated from a Ge:Ga wafer from Eagle-Pitcher with a room temperature resistivity of approx. 12 ohms cm. The wafer is approximately 2 inches in diameter and 0.061 inches thick. The contact material was ion implanted with Boron using 10 to the 14th power ions/sq cm at 25 keV and 2 x10 to the 14th power ions/sq cm at 50 keV. The crystal was then sputter-cleaned and metallized first with sputtered Ti and then sputter Au. In addition to the usual infrared measurements of responsivity and noise, measurements were made of the detectors' response to ionizing radiation. T.M.

N81-28420# Naval Postgraduate School, Monterey, Calif.
DESIGN OF A MAGNETIC TAPE TRANSPORT SYSTEM EMPLOYING STEPPER MOTORS Ph.D. Thesis
Sotirios A. Tsavdaris Dec. 1980 53 p refs
(AD-A100157) Avail: NTIS HC A04/MF A01 CSCL 09/2

A magnetic tape transport system employing stepper motors has been investigated and developed. Before the investigation of the system, a mathematical model for a four-phase permanent magnet stepper motor was developed and its behavior studied by computer simulation. At the beginning, a system was proposed employing a single tension spring between the take-up motor and its reel to maintain a tape tension. From computer simulation, it was found that such a scheme does not regulate tape tension within acceptable limits. A new scheme was proposed using two tension springs between the two motors and their reels. From the simulation, it was shown that this scheme is acceptable since the tape tension is kept between the specified limits and the stepper motors execute the tape transfer commands without any failure. Author (GRA)

N81-28421# General Electric Co., St. Petersburg, Fla. Chemistry Lab.
PUMPING-SPEED-MEASUREMENT TECHNIQUES FOR GETTERS
T. K. Mehrhoff and L. W. Barnes 1981 37 p refs Presented at 10th Ann. Symp. on Appl. Vacuum Sci. and Technol., Tampa, Fla., 9-11 Feb. 1981
(Contract DE-AC04-76DP-00656)
(GEPP-OP-563; CONF-810236-1) Avail: NTIS HC A03/MF A01

Two measurement techniques for measurement of fast and low gettering rates are described. The measurement technique for rapid gettering (0.5 to 9 1/s) is a dynamic method. Here the getter is activated under vacuum while pumping in competition with a reference vacuum pump of known pumping speed and conductance. The gas flow to the reference pump is monitored by a continuous scanning quadrupole mass spectrometer. The example used is an erbium thin film getter pumping on carbon dioxide for temperatures between 300 and 900 C. Sticking coefficients are determined and plotted as a function of Langmuirs of carbon dioxide exposure. The static method is used for

measurement of slower pumping rates. This technique involved activating the getter and exposing it to a closed chamber of gas in the micron region. The gas in the chamber is monitored by opening a low conductance orifice to a pump and mass spectrometer for a few seconds at intervals of approximately two hours. DOE

N81-28422# Ruhr Univ., Bochum (West Germany). Inst. fuer Elektronik.
LOW POWER ION SPECTROMETER FOR HIGH COUNTING RATES Final Report
Juergen W. Klein, Peter Dullenkopf, Albrecht Glasmachers, Joachim Melbert, Wolfgang Winkelnkemper, and Berend Wilken (Max-Planck Inst. Fuer Aeronomie, Katlenburg-Lindau, West Germany) Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 156 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-019; ISSN-0170-1339) Avail: NTIS HC A08/MF A01

The feasibility of a time of flight (TOF) spectrometer which measures ion composition in planetary magnetospheres is demonstrated. The electronic concept of a TOF ion spectrometer for high counting rates and high dynamic range which can be used as a satellite instrument is described in detail. The detection principle of the spectrometer is based on time of flight and energy measurement for each incident ion. The ion mass is related to these two quantities by a simple equation. The mass identification system uses an analog fast-slow scheme; the fast TOF signal preselects the gainstep in the much slower energy channel. The conversion time of the mass identifier is 1 microsec and the dynamic range of the energy channel is better than 1000 (20 keV to 25 MeV). Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-28423 California Univ., Berkeley.
CONTROL OF LATERAL AND LONGITUDINAL MODES OF THE GaAs/(GaAl)As SEMICONDUCTOR LASER Ph.D. Thesis
Chung-Yih Chen 1980 174 p
Avail: Univ. Microfilms Order No. 8112986

Control of lateral and longitudinal modes of the double heterostructure GaAs/(GaAl)As semiconductor laser is studied experimentally and analyzed theoretically. A mode stabilized double current confinement channeled substrate planar (DCC-CSP) laser has developed. With a narrow channel, double current confinement, and uniform excitation, the lateral and longitudinal mode behaviors of the DCC-CSP laser are shown to be of superior quality. A double etching technique (DET) was developed which can be applied to fabricate submicron channels on the GaAs wafer. This technique pushes the linewidth beyond the resolution limit set by diffraction in photolithography. An iterative effective refractive index approximation for improving solutions of waveguiding problems in a general three dimensional dielectric waveguide is also presented. In theory, this technique should give more accurate results than those calculated from the ordinary effective refractive index method. Dissert. Abstr.

N81-28424# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECT OF TEST RHOMBUS SIZE ON PHOTON CORRELATION LASER VELOCIMETER DATA M.S. Thesis
Insha Hamid Dec. 1980 127 p refs
(AD-A094758; AFIT/GAE/AA-80D-7) Avail: NTIS HC A07/MF A01 CSCL 14/2

This thesis provides an experimental evaluation of the effects of test rhombus size on the photon correlation Laser Velocimeters. It also provides a metod and results of laser beam expansion and beam diameter measurements. The study was carried out in the turbulent regime of a plane free jet 1 cm by 10 cm. The flow field measurements were made at 25 jet widths downstream of the nozzle exit, at M - 0.3, usng 0.5, 1.0, 1.1, 3.0, 5.0., 7.0 and 10.0 mm diameter laser beams. The measurements taken were mean velocities and turbulence intensities which were then compared with the theoretical predictions and earlier experimental results. The Laser Velocimeter System provided accurate results for mean velocities, but was found to be limited at higher turbulence levels (above 20 percent) for beam diameters up to and less than 5.0 mm. GRA

N81-28425# Hughes Research Labs., Malibu, Calif.
CORRECTION OF PHASE DISTORTION BY NONLINEAR OPTICAL TECHNIQUES Final Technical Report, 15 Jul. 1977 - 31 Dec. 1980
R. C. Lind, W. B. Brown, R. K. Jain, J. F. Lam, R. A. McFarlane, T. R. OMeara, C. R. Giuliano, B. M. Merchant, and G. C. Valley May 1981 287 p refs
(Contract N00014-77-C-0593; DARPA Order 3427)
(AD-A100345) Avail: NTIS HC A13/MF A01 CSCL 20/5

This is the final report on a program designed to explore a recently recognized property of certain nonlinear optical interactions of generating conjugate wavefronts that can be used to correct optical distortions in laser systems. These distortions include optical train aberrations, laser medium distortions, and atmospheric propagation aberrations. The program was divided into three basic areas that bridge the gap between a preliminary exploration of the applicable nonlinear processes and realization of their potential usefulness to laser systems. The areas were to measure quantitatively the properties of phase conjugation by four-wave mixing and SBS, to develop a theoretical understanding of nonlinear phase conjugation, and to determine the applicability of nonlinear phase conjugation to various systems of interest to DARPA. Experimentally Demonstrated: Four-wave reflectivity exceeding unity in the green; Complete aberration correction by four-wave mixing and SBS for severely aberrated beams (approx. 35X diffraction limit), Viable approaches to angle offset using four-wave mixing; and Input/output separation using polarization properties of four-wave mixing. GRA

N81-28426# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF A NOVEL LASER MATERIAL FOR MINIATURIZED LASER SYSTEMS Quarterly Technical Report, 1 Jan. - 31 Mar. 1981
Walter K. Zwicker, Sel Colak, and Jacob Khurgin May 1981 30 p refs
(Contract MDA903-81-C-0034; DARPA Order 4040)
(AD-A100510; QTR-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

Crystals of NdP5O14 (NPP), NdLiP4O12 (LNP), and NdxY(1-x)Al3(BO3)4 (NAB) have been grown from high-temperature fluxed solutions. LNP crystals of good optical quality could only be grown on the surface of the flux, indicating that top seeding methods might be the most suitable for obtaining large crystals for fabrication of laser rods. Crystals of NAB were small and contained flux inclusions. Other fluxes and various Nd:Y ratios will be used in future experiments to determine if optically clear single-phase crystals can be grown which are large enough for fabrication of laser rods. Fluorescence lifetime and transmission spectra of NPP, LNP, and NAB crystals grown in-house have been measured. The results of these measurements compare favorably with the reported values in the literature. Except in the case of NAB, we have observed increased background absorption in the shorter wavelength region of the visible spectrum. It is believed that this behavior of NAB may be caused by the presence of Pb in the crystal. The experimental laser setup designed previously has been completed. During initial experiments, we measured the output energy per pulse, and observed the transverse-mode structure of the beam and temporal behavior of the output pulse. Author (GRA)

N81-28427# United Technologies Research Center, East Hartford, Conn.
PROGRAM TO INVESTIGATE ADVANCED LASER PROCESSING OF MATERIALS Final Report, 1 Jun. 1978 - 30 Nov. 1980
E. M. Breinan, D. B. Snow, and C. O. Brown Jan. 1981 151 p refs
(Contract N00014-78-C-0387; ARPA Order 3542)
(AD-A100302; UTRC/R81-914346-8) Avail: NTIS HC A08/MF A01 CSCL 13/8

This program included two major areas of research. In the

processing area, a LAYERGLAZE (trade name) apparatus using a powder feed was developed and used to produce a 13.2 cm diameter by 3 cm thick cylindrical blank which was used as a preform for a scale model gas turbine disk. In addition to demonstrating that the process was capable of fabricating model size parts, mechanical testing and microstructural analysis of LAYERGLAZED material indicated that LAYERGLAZED parts exhibit good structural integrity and that the process produces no sizable or serious fabrication flaws provided that the alloy has adequate 'weldability' at high cooling rates. In a second major area, design of a LAYERGLAZE-processable superalloy was undertaken. With the system Ni-Al-Mo - X, numerous processable compositions were found, however, these compositions were characterized by embrittling phase transformations in the 600-800 deg temperature range. The research efforts in the alloy design area aimed at understanding and controlling this instability produced several alloys in the Ni-Al-Mo + X family which appeared to demonstrate the necessary characteristics of processability and phase stability. The mechanical properties of these alloys are being evaluated under an additional program. In addition to alloys from the above system, a number of additional alloys with high strength potentials have been developed based on other systems. GRA

N81-28428# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

WEDGE ABSORPTION REMOTE SENSOR Final Report

Wendell R. Watkins and Kenneth O. White May 1981 30 p refs

(Contract DA Proj. 1L1-61102-B-53A)

(AD-A100521; ERADCOM/ASL-TR-0085) Avail: NTIS HC A03/MF A01 CSCL 20/5

The remote detection of vehicular exhaust as well as battlefield gases is of interest to the Army. Near real-time remote sensing of atmospheric gases can already be performed by using differential absorption lidar or transmission techniques. A new system called the wedge absorption remote sensor has been developed which improves integrated path detection of atmospheric gases. The wedge absorption remote sensor utilizes an emission spike train of short time duration as is found in the long-pulse output mode of a solid-state laser to define the on- and off-line absorption of an atmospheric gas and, hence, its concentration. The wedge absorption remote sensor has performed well as a remote sensor of methane concentrations with an erbium:ytterbium-aluminum-garnet laser as the source. Author (GRA)

N81-28429# Naval Research Lab., Washington, D. C.

DYNAMICS OF LASER-DRIVEN, ABLATIVELY ACCELERATED TARGETS Interim Report

J. Grun 8 May 1981 91 p refs

(Contract DE-AT01-77DP-40042)

(NRL-MR-4491) Avail: NTIS HC A05/MF A01

The characteristics of ablation plasma from planar targets, driven by long Nd:glass laser pulses and the velocity of the ablatively accelerated targets were studied. Ablation plasma diagnostics include arrays of time of flight ion collectors, plasma calorimeters, and ballistic pendula which directly measure the plasma velocity, energy, and momentum. The ballistic pendula were tested and calibrated in the experimental environment. A double foil technique was developed to study the velocity of the accelerated target. Measurements of plasma energy, velocity, and momentum, determine the scaling with irradiance and the absolute magnitudes of the ablation pressure, velocity and ablation depth or mass ablation rate. DOE

N81-28430# California Univ., Livermore. Lawrence Livermore Lab.

DOUBLE-SIDED ELECTRON-BEAM GENERATOR FOR KrF LASER EXCITATION

L. Schlitt and L. Schwingle May 1980 14 p ref

(Contract W-7405-eng-48)

(UCID-18635) Avail: NTIS HC A02/MF A01

A double sided electron beam system for laser fusion application was designed and constructed. A KrF laser producing a minimum output of 25 J was needed for the Raman Amplifier Pumped by Intensified Excimer Radiation (RAPIER) system. Each of the two electron beam machines in the system operates with an rms jitter of 0.4 ns and together they occupy approx. 3.5 sq m of floor space. A description of the design issues and engineering drawings for this KrF laser are included. E.A.K.

N81-28431# California Univ., Livermore. Lawrence Livermore Lab.

NEW PHOTOGRAPHIC TECHNIQUE FOR OBSERVING BULK LASER DAMAGE

John Sonderman, Stan Stokowski, Norman Thomas, Perry Wallerstein, and Dan Walmer 30 Jan. 1981 19 p refs Presented at 12th Ann. Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 30 Sep. - 1 Oct. 1980 Submitted for publication

(UCRL-84843; CONF-8009119-3) Avail: NTIS HC A02/MF A01

A damage site camera was developed to record the onset of bulk laser damage in materials. The camera images and magnifies the damage track using forward scattered laser light. Employing this camera, the presence of very small (10 m) damage sites with densities as low as 10/cc were detected. The camera is used at oblique incidence to the part being tested. Discrete damage sites generated within the bulk of some materials, such as silicate glass, fluorophosphate glass, and KDP crystals, by 1-ns 1064-nm laser were observed. DOE

N81-28432# Los Alamos Scientific Lab., N. Mex.

LASERS AS A TOOL FOR PLASMA DIAGNOSTICS

Franz C. Jahoda 1981 30 p refs Presented at the Los Alamos Conf. on Optics, Santa Fe, N. Mex., 6 Apr. 1981

(Contract W-7405-eng-36)

(LA-UR-81-896; CONF-810429-3) Avail: NTIS HC A03/MF A01

Lasers can be used as non-perturbative probes to measure many plasma parameters. Plasma refractivity is primarily a function of electron density, and interferometric measurements of phase changes with either pulsed or CW lasers can determine this parameter with spatial or temporal resolution over several orders of magnitude sensitivity by using laser wavelengths from the near UV to the far infrared. Laser scattering from free electrons yields the most fundamental electron temperature measurements in the plasma parameter range where individual scattering events are uncorrelated in phase and ion temperature or plasma wave and turbulence structure in the opposite limit. Laser scattering from bound electrons can be many orders of magnitude larger if the laser is matched to appropriate resonance frequencies and can be used in specialized circumstances for measuring low ionized impurity or dominant species neutral concentrations and velocities. DOE

N81-28433# California Univ., Livermore. Lawrence Livermore Lab.

SYSTEM FOR AUTOMATIC X-RAY-IMAGE ANALYSIS, MEASUREMENT AND SORTING OF LASER FUSION TARGETS

R. M. Singleton, D. E. Perkins, and D. L. Willenborg 1980 16 p refs Presented at 14th Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 17-19 Nov. 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-84549; CONF-801170-1) Avail: NTIS HC A02/MF A01

The Automatic X-ray image analysis and sorting (AXIAS) system which is designed to analyze and measure X-ray images of opaque hollow microspheres used as laser fusion targets is described. The X-ray images are first recorded on a high resolution film plate. The AXIAS system then digitizes and processes the images to accurately measure the target parameters and defects. The primary goals of the AXIAS system are: (1) to provide extremely accurate and rapid measurements; (2) to engineer a practical system for a routine production environment; and (3) to furnish the capability of automatically measuring an array of images for sorting and selection. DOE

N81-28434# California Univ., Livermore. Lawrence Livermore Lab.

COHERENCE IN LASER EXCITATION

Bruce W. Shore Feb. 1981 47 p refs Presented at the 2nd Intern Conf. on Multiphoton Processes, Budapest, 14-18 Apr. 1980

(Contract W-7405-eng-48)
(UCRL-84260; CONF-800432-2) Avail: NTIS HC A03/MF A01

Noteworthy effects are reviewed that occur in the detailed time dependence of excited state populations during coherent excitation, as predicted with simplified theoretical modelling of near resonant N level excitation by near monochromatic light. After outlining effects of controllable parameters upon population dynamics, and noting differences between coherent and incoherent excitation the properties of long time averages and of multiphoton resonances, and some interesting periodicities are discussed. DOE

N81-28435# Association Euratom-CEA, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DEVELOPMENT OF TWO UHF BAND RESONATORS FOR APPLICATION TO CO2 LASER ELECTRO-OPTICAL MODULATION
M. G. Egan (University Coll., Cork, Ireland), P. Blanc, and M. C. Sexton (University Coll., Cork, Ireland) Jan. 1980 29 p refs (EUR-CEA-FC-986) Avail: NTIS (US Sales Only) HC A03/MF A01

The design and testing of the UHF band resonators are described. The resonators are destined for use in the linear electro-optical modulator of the CO2 laser rapid interferometer diagnostic for the WEGA Tokamak. The resonators take the form of a re-entrant coaxial line cavity and an interdigital line filter, both of which posses the regions of high electric field necessary to activate the linear electro-optical effect. The design requirements are presented and analyzed. DOE

N81-28436# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
THE USE OF LED'S (LIGHT-EMITTING DIODE) TO SIMULATE WEAK YAG-LASER BEAMS
Matt Young Jan. 1981 50 p refs Sponsored in part by AF (PB81-172470; NBS-TN-1031) Avail: NTIS HC A03/MF A01 CSCL 20E

The conditions under which a light-emitting diode (LED) may be used to simulate a weak Yag-laser beam that has been scattered by a distant reflecting object are determined. The feasibility of testing the receiver of such a pulse with the collimated and filtered radiation of a 1060 m LED is investigated. The differences between laser radiation and LED radiation are examined. It is concluded that there is no theoretical reason that a LED may not be used in place of the laser beam. J.D.H.

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-28437 British Library Lending Div., Boston Spa (England).
THE THREE DIMENSIONAL CALCULATION OF THE UNSTEADY ABSOLUTE FLOW OF AN IDEAL FLUID IN A DIAGONAL CENTRIFUGAL PUMP WITH A SPIRAL HOUSING
J. Raabe Jan. 1981 41 p refs Transl. into ENGLISH from V.D.I. Berichte (Munich), no. 193, 1973 p 63-73
(BLL-RTS-11949) Avail: British Library Lending Div., Boston Spa, England

A centrifugal pump with diagonal flow through the rotor, with blades of a defined skeletal area and pressure and suction edges which lie in axial planes, was examined. A spiral housing is made up of the segments of a circle with spurs running parallel to the shaft. The surfaces of the blade skeleton and the spiral housing are permanently coated with endless elementary vortices. Discrete ring vortices external to the rims of the rotor and permanent vortex layers on discrete coaxial cylinders simulate the flow through the rotor. All the vortex layers have free values which oscillate harmonically on a partially displaced phase to simulate unsteady flow. The displacement effect of the thick ended blades on absolute flow is transmitted to rotating dipoles from the spiral housing to the rotor by rotating depression. All speed ratios in the relative and absolute flow are resolved into harmonics. Ratios are established for the calculation of the unsteady peripheral for force of a moving blade and torque. E.A.K.

N81-28438 Connecticut Univ., Storrs.
THE EFFECTS OF SLIDING FRICTION ON THE STRESSES AND DEFORMATIONS OF AN ELASTIC, SOLID AND RIGHT CYLINDER PRESSED AGAINST A ROUGH RIGID SURFACE Ph.D. Thesis
Rhoby Joseph Conant 1981 150 p
Avail: Univ. Microfilms Order No. 8115315

The problem of a solid, homogeneous, isotropic, right circular cylinder of finite length pressed against a moving, rough, rigid surface is examined within the framework of the linear theory of elasticity. The Papkovich-Neuber potentials are employed to uncouple the governing equations and the resulting equations are solved using integral transform techniques. The solution is reduced to a coupled, infinite system of singular integral equations in which the unknown functions are related directly to the radial and tangential components of the shear stress at the ends of the cylinder. By employing the method of collocation, the system of integral equations is reduced to an infinite system of linear algebraic equations which is then solved by the reduction method. Results are presented for the appropriate components of stress and displacement at the ends of the cylinder both for the frictionless and the frictional case. Dissert. Abstr.

N81-28439 George Washington Univ., Washington, D.C.
ANALYSIS OF THE FLOW IN THE PREROTATION DUCTS OF A FLUID DYNAMIC ENERGY SEPARATOR Ph.D. Thesis
Ashok Siddanagouda Patil 1980 112 p
Avail: Univ. Microfilms Order No. 8112875

The flow transients in the prerotation ducts of the Fluid Dynamic Energy Separator are analyzed. The flows in both branches of the dual prerotator are considered simultaneously, making it possible to relate the rotor speed to the size, number, inclination, and efficiency of the rotor nozzles on the hot and cold sides. Two cases are considered: that in which the rotor discharge takes place through a finite number of nozzles; and that in which it takes place through a wall of diffused porosity. In dealing with the former case, the flow in the prerotation ducts is treated by the method of characteristics for nonsteady flow, whereas in dealing with the latter case it is treated as steady. The calculated temperature increments are found to be higher in the steady state operation than during the initial transient, the difference being attributable to the fact that inflow and outflow of mass and energy in each cycle do not become equal until the steady state is reached. Dissert. Abstr.

N81-28440 Minnesota Univ., Minneapolis.
BIFURCATION TO PERIODIC SOLUTIONS IN ROTATIONALLY SYMMETRIC DISCRETE MECHANICAL SYSTEMS Ph.D. Thesis
Anil Kumar Bajaj 1981 201 p
Avail: Univ. Microfilms Order No. 8114968

Rotationally symmetric discrete mechanical systems governed by nonlinear ordinary differential equations and dependent on a parameter are analyzed for small periodic solutions when the equilibrium configuration of the system loses stability at some critical value of the parameter with complex conjugate pairs of eigenvalues of the linearized system crossing the imaginary axis. Two distinct possibilities are shown to exist. In one case, the symmetry of the system induces multiplicity of the complex pairs while in the second case, despite the symmetry of the system, only one complex pair crosses the imagery axis. The second case corresponds to the Hopf-bifurcation and whirling in rotating shafts is shown to be an example. The problem of nonlinear, nonplanar flow induced oscillations in articulated pipes carrying a fluid is then analysed and supercritical as well as subcritical periodic solutions over a wide range of system parameters are shown to exist. Dissert. Abstr.

N81-28441 Iowa Univ., Iowa City.
GENERALIZED COORDINATE PARTITIONING IN DYNAMIC ANALYSIS OF MECHANICAL SYSTEMS Ph.D. Thesis
Roger Arthur Wehage 1980 202 p
Avail: Univ. Microfilms Order No. 8114313

A computer-based method for formulation and efficient

solution of nonlinear, constrained differential equations of motion is developed for planar mechanical systems. Nonlinear holonomic constraint equations and differential equations of motion are written in terms of a maximal set of Cartesian generalized coordinates, to facilitate the general formulation of constraints and forcing functions. A Gaussian elimination algorithm with full pivoting decomposes the constraint Jacobian matrix, identifies dependent variables, and constructs an influence coefficient matrix relating variations in dependent and independent variables. This information is employed to numerically construct a reduced system of differential equations whose solution yields the total system dynamic response. A general method is developed for dynamic analysis of systems with impulsive forces, impact, discontinuous constraints, ad discontinuous velocities. Numerical results are presented for planar motion of a tracked articulated vehicular system with twenty-four degrees of freedom. Dissert. Abstr.

N81-28442*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FRACTURE ANALYSIS OF HPOTP BEARING BALLS
Biliyar N. Bhat May 1981 27 p refs
(NASA-TM-82428) Avail: NTIS HC A03/MF A01 CSCL 13I

The fracture analysis conducted on four HPOTP (High Pressure Oxygen Turbopump) bearing balls from the SSME (Space Shuttle Main Engine) is described. Nondestructive evaluation, optical microscopy, and transmission microscopy techniques were used in the analysis. The cracks are initiated at or close to the ball surface under conditions of high cyclic stresses and high coefficient of friction. The cracks lead to spalls and subsequent crack propagation occurs by fatigue mode under concentrated loading of cyclic nature. S.F.

N81-28443*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESS CONCENTRATION IN THE VICINITY OF A HOLE DEFECT UNDER CONDITIONS OF HERTZIAN CONTACT
Takashi Yamamoto (Tokyo Univ. of Agriculture and Technology), Masao Eguchi (Tokyo Univ. of Agriculture and Technology), and Kosho Murayama (Tokyo Univ. of Agriculture and Technology) 1981 25 p refs Proposed for presentation at the Joint Lubrication Conf., New Orleans, 5-7 Oct. 1981; sponsored by ASME and the American Society of Lubrication Engineers
(NASA-TM-82649; E-907) Avail: NTIS HC A02/MF A01 CSCL 20K

Two dimensional photoelastic stress analyses were conducted for epoxy resin models containing a hole defect under the conditions of Hertzian contact. Stress concentrations around the defect were determined as a function of several parameters. The effect of tangential traction on the stress concentration was also determined. Sharp stress concentrations occur in the vicinity of both the left and the right side of the hole. The stress concentration becomes more distinct the larger the hole diameter and the smaller distance between the hole and the contact surface. The stress concentration is greatest when the disk imposing a normal load is located at the contact surface directly over the hole. The magnitude and the location of stress concentration varies with the distance between the Hertzian contact area and the hole. The area involved in a process of rolling contact fatigue is confined to a shallow region at both sides of the hole. It was found that the effect of tangential traction is comparatively small on the stress concentration around the hole. E.A.K.

N81-28444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED SOLUTION FOR STRESSES AND DEFORMATION
Bernard J. Hamrock and David E. Brewe 1981 25 p refs Proposed for presentation at the Joint Lubrication Conf., New Orleans, 5-7 Oct. 1981; sponsored by the Am. Soc. of Lubrication Eng. and ASME Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-82647; E-905; AVRADCOM-TR-81-C-14) Avail: NTIS HC A02/MF A01 CSCL 20K

Conventional contact deformation analysis for ball bearings, gears, and cams involves tedious iterative procedures or the use of design charts. A simplified approach that makes the elastic deformation at the center of contact easy to calculate was previously reported. The range of validity in which these equations can be used is extended. A simplified approach to the calculation of the location and magnitude of subsurface stresses developed in machine element applications is included. S.F.

N81-28445# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GRADE. PART 9: USER'S MANUAL Interim Report, 15 Nov. 1979 - 15 Oct. 1980
D. S. Wilson and C. H. T. Pan Wright-Patterson AFB, Ohio AFAPL Apr. 1981 249 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A100210; SRC-80-TR-58; AFAPL-TR-78-6-Pt-9) Avail: NTIS HC A11/MF A01 CSCL 21/5

RSVP (acronym) for Rotor Structure Vibration Program is a computer program for use in the dynamic analysis of rotating shafts. This manual outlines the procedures to be followed in utilizing the computer program, covering input and output description and includes two rotor examples covering the five major capabilities of the program. The reader is referred to AFAPL-TR-78-6, part I, Flexible Rotor Dynamics, (AD-A087 806), for a more detailed discussion of RSVP. This manual also furnishes guidance to the first-time reader in the efficient utilization of the series. Author (GRA)

N81-28446# Naval Research Lab., Washington, D. C.
SEA SALT SPRAY INGESTION BY FFG GAS TURBINES Final Report, 11 Apr. - 30 Aug. 1980
R. E. Ruskin (AMAF Industries, Inc., Columbia, Md.). F. K. Lepple, and R. K. Jeck 9 Jun. 1981 35 p
(AD-A100506; NRL-MR-4419) Avail: NTIS HC A03/MF A01 CSCL 13/11

At-sea measurements of salt spray in the FFG-13 main propulsion gas turbine intake found 50 times more salt than on the DD963 at similar sea state. This factor of 50 resulted from (1) ten times more salt being present upstream of the inlet filters because of the inlet placement lower and flush with the hull as compared to the DD963 inboard placement, and (2) at least five times greater percentage of salt penetration through the FFG knit mesh filter medium as compared to the DD963 'barrier' or coalescer pad type of filter. The more 'open' filter medium was needed on the FFG in order to minimize pressure drop across the filter with the smaller filter space which was available with allowance for the space required for a settling chamber or 'drop space' upstream of the filters. This salt survey also determined that the drop space, while needed for green water, does not reduce the salt loading at the filter in the small particle sizes (- 20 micrometers) which create the principal problem in salt filtration. In view of this finding, NRL recommends (for the long term) retrofitting the filter mounting to change it from athwartship to diagonally fore-to-aft with a resultant reduction in drop space, but enlargement of the filter mounting space to permit use of the tighter (higher pressure drop) 963 type coalescer pads for combined inlet and secondary cooling air filtration. For the short term it is recommended that the previous monthly engine water wash cycle be supplemented with a daily non-detergent wash of the compressor stages during at-sea missions. The water tank plumbing may need to be upgraded in order to facilitate under-way washing. GRA

N81-28447# Bendix Corp., Kansas City, Mo.
VISUAL THREAD QUALITY FOR PRECISION MINIATURE MECHANISMS
L. K. Gillespie Apr. 1981 108 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2600) Avail: NTIS HC A06/MF A01

Threaded features have eight visual appearance factors which affect their function in precision miniature mechanisms. The practice in deburring, finishing, and accepting these conditions on miniature threads is described as is their impact in assemblies of precision miniature electromechanical assemblies. DOE

N81-28448# California Univ., Livermore. Lawrence Livermore Lab.
PRECISION MACHINING COMMERCIALIZATION
1981 245 p refs
(Contract W-7405-eng-48)
(UCID-17948-Rev-1) Avail: NTIS HC A11/MF A01

The Precision Machining Commercialization Project (PMC) is described. The goal of PMC is to minimize precision machining development time and cost risk for interested vendors. The technology of high precision machining is based on a number of refinements of fundamental machining principles such as better slideways, more accurate spindles, better control systems, better thermal stability, isolation from vibration, application of the laser interferometer for closed-loop tool position control, and part handling and chucking with a sensitivity to fractions of micrometer tolerance. A critical element is the diamond tool bit, which cuts precisely in accordance with its geometry without the built-up edge characteristic of other tools, thus offering the potential of the mirror finish needed for optical parts. A special section covers the purchase, care, application, measuring and sharpening of diamond tool bits. DOE

N81-28449# Sandia Labs., Albuquerque, N. Mex.
GUY CABLE DESIGN AND DAMPING FOR VERTICAL AXIS WIND TURBINES
Thomas G. Carne 1981 9 p refs Presented at the 2nd DOE/NASA Wind Turbine Dyn. Workshop, Cleveland, 24 Feb. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-2669C; CONF-810226-3) Avail: NTIS HC A02/MF A01

Design parameters affecting the support strength and the stiffness of the guy at the top of the turbine are discussed. Limiting the axial load which the guys apply to the tower, bearings, and foundations is an important objective of cable design. The lateral vibrations of the cables is considered. A graph of modal frequencies versus cable stiffness is presented. A technique for damping cable vibrations is mathematically analyzed and demonstrated with experimental data. DOE

N81-28450# Rockwell International Corp., Golden, Colo. Energy Systems Group.
BURRS FORMED IN PRODUCING SMALL HOLES
Marvin W. Burnham 1981 11 p refs Presented at the SME Intern. Tool and Manufacturing Eng. Conf. and Exposition, Detroit, 27 Apr. 1981
(Contract DE-AC04-76DP-03533)
(RFP-3195; CONF-810427-1) Avail: NTIS HC A02/MF A01

Several cases in which residual material must be removed from parts containing small holes are discussed. It is concluded that in many cases no burr removal technique is acceptable, and deburring should not be attempted. DOE

N81-28451# Bendix Corp., Kansas City, Mo.
GAGE CHUCKING MECHANISM Final Report
T. Yotter Feb. 1981 31 p
(Contract DE-AC04-76DP-00613)
(BDX-613-2560) Avail: NTIS HC A03/MF A01

Contour gage chucking mechanisms when chucked exert an extraneous force on the contour of parts tested. The evaluation of these forces showed no significant change in part contour and greater repeatability at higher chucking torques. The torque wrench used to torque the gage chucking mechanism, however, was determined to be inaccurate and was replaced with a torque wrench of greater accuracy. The gage is computer operated and provides a printout with test disposition for each part tested. DOE

N81-28452# Department of Energy, Morgantown, W. Va. Valve Testing and Development Projects.
TEST AND EVALUATION OF TWO SIGMON CORPORATION 6-INCH TYPE K BALL VALVES METC SOA TEST VALVE NO. A-4 AND METC SOA TEST VALVE NO. B-4 FOR LOCKHOPPER SERVICE IN COAL CONVERSION
John F. Gardner 28 Feb. 1981 78 p refs
(DOE/METC-SP-129) Avail: NTIS HC A05/MF A01

Two 6-inch Sigmon Corporation type K blocking ball valves were evaluated. Significant difficulties were encountered when performing tests. Problems included excessive leakage rates, galling of valve seats and balls, and a broken valve stem. In the tested configuration, the subject test valves are not recommended for severe service block and seal applications in coal conversion. DOE

N81-28453# Naval Research Lab., Washington, D. C. Laser Physics Branch.
METAL VAPOR RAMAN COMPRESSOR Final Report, 1 Apr. 1979 - 31 Mar. 1980
1980 66 p refs
(Contract DE-AI08-79DP-40104)
(DOE/DP-40104/T1) Avail: NTIS HC A04/MF A01

The feasibility of a long Pb vapor cell is demonstrated and the potential of the XeCl-Pb system as a Raman pulse compressor is assessed. A narrow bandwidth XeCl laser was developed and an 8 m Pb vapor cell was constructed. Details on the laser device and the results of the experiment are given. DOE

N81-28454# Delft Hydraulics Lab. (Netherlands).
THE DYNAMIC BEHAVIOR OF NON-RETURN VALVES
G. A. Provoost May 1980 14 p refs Presented at 3rd Intern. Conf. on Pressure Surges, Canterbury, England, 25-27 Mar. 1980
(Publ-229) Avail: NTIS HC A02/MF A01

A test rig which evaluates the dynamic behavior of non-return valves is described. The circuit allows a sudden reverse of the flow in order to determine whether slamming is to be expected during transient flow. Upstream and downstream pressures can be measured during decreasing and possibly reversed flow under various conditions. The results of tests carried out for two of non-return valves are shown. The fluid velocity gradient with time is of decisive importance when considering the dynamic performance of non-return valves. Author (ESA)

N81-28455# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
SOME ASPECTS OF THE DESIGN OF THE SUSPENSION SYSTEMS OF HEAVY GOODS VEHICLES
P. H. Baas Oct. 1980 27 p refs
(TT-8003) Avail: NTIS HC A03/MF A01

Work being done to improve ride comfort and dynamic road loading of heavy goods vehicles is reviewed. The topics covered include vibration isolation systems, linked axle behavior, stiffness of chassis frame, dynamic coupling of vehicles, mathematical modeling and fatigue testing. It is shown that considerable improvement in the design of heavy goods vehicles is possible. A well designed vehicle, 37% heavier than typical 32 ton vehicles can be 9% more efficient in terms of fuel consumption per ton of pay load and cause less road damage. Increasing the stiffness of the chassis improves ride comfort and results in less weight and complexity in the payload container. Author (ESA)

N81-28456# Texas Univ. at Arlington. Structural Engineering Lab.
EFFECT OF AXIAL LOAD ON SHEAR BEHAVIOR OF SHORT RC COLUMNS UNDER CYCLIC LATERAL DEFORMATIONS
H. Ramirez and J. O. Jirsa Jun. 1980 175 p refs
(Grant NSF ENV-77-20816)
(PB81-163503; PMFSEL-80-1; NSF/RA-800377) Avail: NTIS HC A08/MF A01 CSCL 13M

The influence of axial loads on the behavior of reinforced concrete short columns under cyclic bidirectorial deformations was studied. The experimental program consisted of ten tests of short column specimens subjected to predetermined load sequences. All specimens had the same geometry and reinforcement. Their shape was selcted to simulate a short column framing into a stiff floor system. Lateral loading was controlled by monitoring deformations. The main effect of axial compression was an increase in shear strength and acceleration of shear deterioration at higher levels of deformation when compared with that of a specimen without axial loads. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-28457 British Library Lending Div., Boston Spa (England).
ULTRASONIC WAVE FLAW TESTING OF WELDS OF VERY

THICK STEEL PLATES BY THE MULTIPROBE TANDEM FLAW DETECTION METHOD

Tadaaki Onishi, Yukihiro Terada, Masahiro Nakabayashi, Yoshio Tsujisaki, and Takashi Yamada 1 Jul. 1980 16 p refs Transl. into ENGLISH from Hitachi Zosen Giho (Japan), v. 36, pt. 4, 1975 p 268-73

(BLL-RISLEY-TR-4148-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, England

The decrease in the detectability of planar flaws in ultrasonic flaw detection testing of thick plates, and the effectiveness of the multiprobe tandem flaw detection method as a solution to this problem were investigated. A trial flaw detector to investigate the detectability of various kinds of artificial flaws was constructed. It was found that the multiprobe tandem flaw detection method is better for detecting planar flaws extending in the direction of the plate thickness than the single probe flaw detection method which is the commonest of the ultrasonic wave flaw detection methods. E.A.K.

N81-28458*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ACOUSTO-ULTRASONIC CHARACTERIZATION OF FIBER REINFORCED COMPOSITES

Alex Vary 1981 14 p refs Presented at the Office of Naval Res. Conf. A Critical Rev: Tech. for the Characterization of Composite Mater., Cambridge, Mass., 8-10 Jun. 1981

(NASA-TM-82651; E-910) Avail: NTIS HC A02/MF A01 CSCL 14D

The acousto-ultrasonic technique combines advantageous aspects of acoustic emission and ultrasonic methodologies. Acousto-ultrasonics operates by introducing a repeating series of ultrasonic pulses into a material. The waves introduced simulate the spontaneous stress waves that would arise if the material were put under stress as in the case of acoustic emission measurements. These benign stress waves are detected by an acoustic emission sensor. The physical arrangement of the ultrasonic (input) transducer and acoustic emission (output) sensor is such that the resultant waveform carries an imprint of morphological factors that govern or contribute to material performance. The output waveform is complex, but it can be quantitized in terms of a 'stress wave factor.' The stress wave factor, which can be defined in a number of ways, is a relative measure of the efficiency of energy dissipation in a material. If flaws or other material anomalies exist in the volume being examined, their combined effect appears in the stress wave factor. S.F.

N81-28459# Southwest Research Inst., San Antonio, Tex.

NONDESTRUCTIVE TESTING INFORMATION ANALYSIS CENTER, 1980 Annual Technical Report, 15 Feb. 1980 - 15 Feb. 1981

Richard T. Smith Watertown, Mass. Army Materials and Mechanics Research Center Jun. 1981 35 p refs

(Contract DLA900-79-C-1266)

(AD-A100147; SWRI-15-5607-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

During the reporting period, NTIAC's computerized data file grew to approximately 20,000 records. The NTIAC Newsletter was distributed to over 4000 recipients. Ninety-three inquires (technical, bibliographic, and general) were responded to. Publication were: NDE Applications of Magnetic Leakage Field Methods, and Technology Assessment of Optical Methods for Nondestructive Evaluation, Part 1 and Part 2. Two drafts on Composite NDE have been prepared. Author (GRA)

N81-28460# Lockheed-Georgia Co., Marietta.

NEW ULTRASONIC STANDARD DESIGN CRITERIA Final Report, Sep. 1979 - Sep. 1980

W. H. Sproat Wright-Patterson AFB, Ohio AFWAL Jan. 1981 63 p refs

(Contract F33615-79-C-5022; AF Proj. 2418)

(AD-A100321; LG81ER0125; AFWAL-TR-80-4198) Avail: NTIS HC A04/MF A01 CSCL 14/2

The purpose of this effort was to identify, on solid theoretical grounds, an alternative approach, to the standardization and calibration of ultrasonic nondestructive evaluation (NDE) systems, which would overcome the limitations of the commonly employed flat bottom hole standards, and to design and fabricate a laboratory prototype device to demonstrate the alternative approach to NDI standards. After establishment of the performance criteria to be met by the alternative standard, an approach based on a software programmable electronic standard simulator was selected for the design and construction of the prototype demonstration device. The resulting device has the capability of assisting the user in: equipment checkout and calibration, set-up on reference standards and diagnosis of equipment malfunctions. The ultrasonic standard simulator may be used in either an automatic mode, to perform pre-programmed tests or in a manual mode to evaluate and/or calibrate either the ultrasonic electronic equipment on the entire inspection system including both electronics and transducers. GRA

N81-28461# Claremont Mens Coll., Calif. Inst. of Decision Science.

A DECREASING FAILURE RATE, MIXED EXPONENTIAL MODEL APPLIED TO RELIABILITY

Janet M. Myhre and Sam C. Saunders Jun. 1981 25 p refs (Contracts N00014-78-C-0213; N00014-79-C-0755)

(AD-A100550; Rept-81-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Decreasing failure rates for electronic equipment used on the Polaris, Posiedon and Trident missile systems have been observed. The mixed exponential distribution has been shown to fit the life data for the electronic equipment on these systems. This paper discusses some of the estimation problems which occur with the decreasing failure rate mixed exponential distribution when the test data is censored and only a few failures are observed. For these cases sufficient conditions are obtained that maximum likelihood estimators of the shape and scale parameters for the distribution exist. Actual data, obtained from the testing of missile electronic packages, are provided to illustrate these concepts and verify the applicability and usefulness of the techniques described. Author (GRA)

N81-28462# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Technological Centre.

THE RESONANCE-IMPEDANCE METHOD AS A MEANS FOR QUALITY CONTROL OF ADVANCED FIBER REINFORCED PLASTIC STRUCTURES

Rob J. Schliekelmann 1980 16 p refs

(FOK-BO-1239) Avail: NTIS HC A02/MF A01

The principles of resonance impedance testing applied to the mechanical properties of bonded structures are reviewed. For fiber reinforced laminates, the influence of laminate thickness, voids and density variations are discussed. The use of reference standards, showing acceptable laminate quality for each configuration, is cited for complicated composite structures. Ultrasonic C-scan pictures of a carbon fiber epoxy laminate are compared with Fokker Bond Tester readings of the same panel, showing the presence of voids. Applications of the resonance-impedance method during the fabrication of structures for the F-14, the B-1 bomber, and for the DC-10 are mentioned. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-28463 Illinois Univ. at Urbana-Champaign.

SECOND-ORDER EFFECTS IN PROBLEMS FOR A CLASS OF ELASTIC MATERIALS Ph.D. Thesis

Injae Choi 1981 95 p

Avail: Univ. Microfilms Order No. 8114401

For a special class of elastic materials, the inverse deformation is always possible in the same material. This result is used to simplify the determination of second order effects in problems for this special class. The second order solution for indentation of a half space by a smooth rigid sphere is determined. For

indentation by a flat ended circular punch it is found that the second order solution for compressible materials is physically inadmissible, while the solution for incompressible materials involves a concentrated line load at the edge of the punch. A spherical elastic inclusion embedded in an elastic matrix with uniform stresses at infinity is considered, and the special cases of a spherical hole and a rigid inclusion are treated.
Dissert. Abstr.

N81-28464 California Univ., Berkeley.
NUMERICAL METHODS FOR DYNAMIC SUBSTRUCTURE ANALYSIS Ph.D. Thesis
John Martin Dickens 1980 205 p
Avail: Univ. Microfilms Order No. 8113013

Efficient algorithms for dynamic analysis are presented in three areas: response of a structure subjected to time history loading; eigenvalue solution for a structure in a substructure formulation; and the response of a structure with limited nonlinear elements to a time history loading. For the response of a structure subjected to an arbitrary time history loading, dynamic correction term is formulated that increases the efficiency of the modal truncation (modal superposition) algorithm. An efficient time domain solution algorithm for the response of a structure subjected to an arbitrary periodic loading is presented and contrasted to the traditional frequency domain method. The concepts contained in the Dynamic Substructure Iteration algorithm are used in the formulation of an efficient algorithm for the response of a structure with a limited number of nonlinear elements subjected to a time history loading. Dissert. Abstr.

N81-28465 California Univ., Berkeley.
SCATTERING OF RAYLEIGH WAVES BY A PLATE ATTACHED TO A HALF SPACE THROUGH A VISCOUS COUPLANT Ph.D. Thesis
Yves Christian Angel 1980 93 p
Avail: Univ. Microfilms Order No. 8112949

A study is presented of the interaction between an electromechanical transducer plate element and wavelengths in the test structure comparable to the plate dimensions. The steady time-harmonic problem is reduced to a system of singular integral equations for determining the tractions generated at the interface between the plate and half space where a thin viscous couplant is applied. These equations are found to have different types of singular solutions depending on the parameter values. They are solved numerically for a specific set of physical parameters that includes a wide range of values of the couplant viscosity and incident wavelength. Dissert. Abstr.

N81-28466 State Univ. of New York at Buffalo.
STRAIN-DEPENDENT CREEP DAMAGE IN RANDOM INHOMOGENEOUS MATERIALS Ph.D. Thesis
Chin-Sheng Lee 1981 61 p
Avail: Univ. Microfilms Order No. 8114689

Employing homogeneous strain dependent creep damage theory, the propagation of a failure front in a beam under pure bending is studied. A local inhomogeneous strain dependent creep damage theory is postulated, based on creep damage data obtained for specimens of various lengths. Using this inhomogeneous theory, solutions for various loading conditions are obtained, and are shown to be in better agreement with observation than previous theories. The effect of random material parameters on the rupture time is considered for the constant tensile stress test and for the beam under pure bending.
Dissert. Abstr.

N81-28467 California Univ., Berkeley.
THE J-INTEGRAL AS A FRACTURE PARAMETER Ph.D. Thesis
Jacques Henri Giovanola 1980 333 p
Avail: Univ. Microfilms Order No. 8113043

A discussion of the equivalance of the J integral and the crack opening displacement yields useful information about the characterization of the crack tip environment by the J integral, as well as a better physical interpretation of this latter parameter. It also allows the load level as expressed by J and the zone of large deformations at the crack tip, where, the microstructural processes involved in fracture take place, to be related.
Dissert. Abstr.

N81-28468 Delaware Univ., Newark.
ON APPLICATIONS OF SOME FUNCTION SPACE METHODS IN HEAT CONDUCTION, ELASTICITY, AND THERMOELASTICITY Ph.D. Thesis
Kwang Ho Cho 1981 253 p
Avail: Univ. Microfilms Order No. 8113897

The method of orthogonal projections is applied to the problem of heat conduction in an infinitely long, uniform elastic bar heated by an electric current. The surface of the bar is kept at the temperature zero. Three kinds of cross sections of the bar are considered: elliptical, equilateral triangular; and in the form of a circular sector. The second method of functional analysis used is that of the hypercircle. The method applied to elasticity, represents states of stress (or deformation) of the body by a vector in a vector space. The vector exhibits the strain energy of the body. The exact solution of the problem is approached by means of two sets of approximations: one set satisfying the equilibrium equations and the boundary conditions; the other set satisfying the compatibility equations and the displacement boundary conditions. The subspaces, consisting of these sets, are orthogonal to each other and the tip of the vector of the exact solution lies on the intersection of the subspaces.
Dissert. Abstr.

N81-28469 Illinois Univ. at Urbana-Champaign.
THE EFFECT OF DISCONTINUITIES ON THE FATIGUE BEHAVIOR OF TRANSVERSE BUTT WELDS IN STEEL Ph.D. Thesis
Mark Douglas Bowman 1981 246 p
Avail: Univ. Microfilms Order No. 8114390

The variables that influence the fatigue behavior of transverse butt welded steel members containing various weld discontinuities were evaluated: fatigue based weld quality rating criteria were formulated. Mathematical models for evaluating the fatigue strength of welds containing discontinuities were developed from empirical fatigue relationships. An experimental program was conducted to examine the accuracy of the mathematical models. Fatigue tests were conducted on notched mild steel plain plate specimens, welded mild steel and quenched and tempered steel specimens containing artificial discontinuities, and quenched and tempered transverse butt welded steel specimens containing slag inclusions. Strain relaxation tests were conducted also to determine the magnitude and distribution of residual stresses in the quenched and tempered steel welds. Dissert. Abstr.

N81-28470 Pennsylvania State Univ., University Park.
CRACK PATTERNS OF REINFORCED CONCRETE SLABS Ph.D. Thesis
Ramon F. Borges 1981 220 p
Avail: Univ. Microfilms Order No. 8112789

A finite element model of a reinforced concrete slab is developed for a computer analysis which predicts the behavior of the slab in terms of the crack pattern. The structural behavior of the slab in the vicinity of an interior slab-column connection is studied under monotonically increasing loading conditions. Modified finite elements are used and most of the actual changes taking place in the slab as the concrete cracks at a section are considered. In order to test the validity of the assumptions made with regard to the material behavior and the characteristics of the finite element model as described herein, the computer analysis is compared with experimental results for a particular slab specimen. Dissert. Abstr.

N81-28471 Purdue Univ., Lafayette, Ind.
FREQUENCY EFFECT ON FATIGUE CRACK PROPAGATION IN PMMA PANELS Ph.D. Thesis
Yuan-Fang Chou 1980 114 p
Avail: Univ. Microfilms Order No. 8113660

The effect of loading frequency on fatigue crack propagation was found to be significant in some alloys and high polymers. A significant decrease in fatigue crack propagation rate with increasing cyclic frequency was observed. The equation used to describe this phenomenon has the same expression as Paris' power law, in which some parameters are frequency dependent. An attempt to find a new fatigue crack propagation law for viscoelastic media under constant amplitude tension-cyclic loads is described. The strain intensity factor is used in developing the new propagation law in lieu of the widely used stress

intensity factor. The magnitude of the strain intensity factor is independent of frequency in elastic materials but is a frequency dependent parameter in viscoelastic media. By employing the strain intensity ratio and strain intensity factor, a new fatigue crack propagation law is proposed without the explicit use of loading frequency as a variable. Dissert. Abstr.

N81-28472 Iowa Univ., Iowa City.
OPTIMIZATION OF STRUCTURES WITH REPEATED EIGENVALUES Ph.D. Thesis
Kyung Kook Choi 1980 103 p
Avail: Univ. Microfilms Order No. 8114246

Structural optimization problems in which eigenvalues may occur are formulated and analyzed. Several optimal design problems are presented that exhibit a repeated eigenvalue at an optimum design. Elementary examples show that for some values of defining parameters for these problems, repeated eigenvalues occur and for other values only simple eigenvalues occur. The examples show that repeated eigenvalues at an optimum design can occur and must be accounted for in theory and numerical methods of structural optimization. A formal Lagrange multiplier method is analyzed and it is shown that the formal Lagrange multiplier method is not valid in general. Recent results concerning the derivative of the eigenvalues is used in design sensitivity analysis of the eigenvalues and the gradient projector method is applied for optimization to formulate a numerical method for solving structural optimization problems in which repeated eigenvalues may occur. Dissert. Abstr.

N81-28473*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
CONVERGENCE RATES FOR FINITE ELEMENT PROBLEMS WITH SINGULARITIES. PART 1: ANTIPLANE SHEAR Interim Report
Robert Plunkett (Minnesota Univ.) Feb. 1980 25 p refs
(NASA-CR-164633; IR-18; VPI-E-80-8) Avail: NTIS HC A02/MF A01 CSCL 20K

The problem of a finite crack in an infinite medium under antiplane shear load is considered. It is shown that the nodal forces at the tip of the crack accurately gives the order of singularity, that n energy release methods can give the strength to better than 1 percent with element size 1/10 the crack length, and that nodal forces give a much better estimate of the stress field than do the elements themselves. The finite element formulation and the factoring of tridiagonal matrices are discussed. A.R.H.

N81-28474# Queensland Univ., St. Lucia (Australia). Dept. of Civil Engineering.
BUCKLING APPROXIMATIONS FOR LATERALLY CONTINUOUS ELASTIC I-BEAMS
P. F. Dux and S. Kitipornchai Apr. 1980 59 p refs
(RR-CE-11) Avail: NTIS HC A04/MF A01

An approximate method was developed for determining the elastic flexural torsional buckling loads of laterally continuous structures. The method can be applied to structures loaded at braced joints. The braces and supports are assumed to prevent lateral deflection and twisting. The procedure locates a critical segment and adjacent restraining segments which together form a substructure. The elastic critical load is obtained by determining the effective length of the critical segment. Charts of effective length factors are presented and are shown to depend on the end restraint parameters, the segment beam parameter, and the end moment ratio. The proposed method is applied to a number of worked examles. Results are in close agreement with accurate numerical solutions. A.R.H.

N81-28475# Queensland Univ., St. Lucia (Australia).
ELASTO-PLASTIC ANALYSIS OF CABLE NET STRUCTURES
J. L. Meek and P. L. D. Brown Nov. 1979 30 p refs
(RR-CE-5) Avail: NTIS HC A03/MF A01

A Newton-Ralphson method is presented for the analysis of cable and structures in which some of the members exhibit elastoplastic behavior. It is presumed that an initial cable net equilibrium exists and that further loads are applied to a portion of the net so that some member forces exceed the elastic limit of their load deflection curve. A device is described for stabilizing the nonlinear iteration procedure which is found to be greatly influenced by the behavior of the elastoplastic members. Author

N81-28476# Queensland Univ., St. Lucia (Australia).
THE ANALYSIS OF THERMAL STRESS INVOLVING NON-LINEAR MATERIAL BEHAVIOR
G. Beer and J. L. Meek Apr. 1980 33 p refs
(RR-CE-10) Avail: NTIS HC A03/MF A01

The finite element method is used to analyze the transient heat phenomena due to welding and the subsequent elastoplastic stress. It is assumed that the temperature distribution can be calculated independently from the stress analysis. Von-Mises plasticity is used with variation of material properties with temperature. Results are presented for the effect of a weld line across the edge of a flat plate, and the residual stresses are compared with experimental values. A.R.H.

N81-28477# North Carolina State Univ., Raleigh. Dept. of Engineering Research.
DIFFUSION AND CREEP IN NIOBIUM CARBIDE AS A FUNCTION OF TEMPERATURE AND CARBON CONTENT Final Report, 1 Mar. 1975 - 30 Mar. 1981
Robert F. Davis 5 Jun. 1981 20 p refs
(Grant DAAG29-75-G-0113)
(AD-A100857; ARO-12487.7-MS) Avail: NTIS HC A02/MF A01 CSCL 07/2

The transition metal carbides possess a combination of some of the highest melting points, hardness values and mechanical strengths of any known materials. The contemporary interest in these materials in structural and cladding applications at temperatures where most materials would be molten or would seriously degrade made it imperative that the high temperature diffusion and deformation processes and their relationship to each other be understood. Thus, the principal thrusts of this ARO-sponsored program have been the conduct of self-diffusion studies of 14C and 95Nb in single crystals of NbC0.868 NbC0.834 and NbC0.766 and constant stress compressive creep research on the same materials. Extensive characterization of these materials has also been performed. GRA

N81-28478# Naval Surface Weapons Center, White Oak, Md.
THE INFLUENCE OF AN INITIAL STRESS ON THE NON-LINEAR RESPONSE OF SUBMERGED CYLINDRICAL SHELLS Final Report, Jan. - Aug. 1980
Michael E. Giltrud and Kenneth C. Kiddy 26 Mar. 1981 23 p refs
(SF33351392)
(AD-A100400; NSWC/TR-80-475) Avail: NTIS HC A02/MF A01 CSCL 20/11

This work assesses the influence of an initial stress field on the non-linear, elastic-plastic response of a submerged isotropic cylindrical shell to transient acoustic loading. Whereas analytical solutions have been obtained for the linear response of such shells to simple temporal and spatial loadings, numerical solutions must be used for the more general case. The Doubly Asymptotic Approximation (DAA) when used in conjunction with the finite element method has been shown to good results for the elastic response of submerged general structures to transient acoustic loadings. However, these methods have just recently been applied to the non-linear case. The approach taken by this work is numerical and in particular applies the USA-STAGS code which combines the finite element method for the linear case, then we evaluate the effect of both geometric and material non-linearities on the response of submerged cylindrical shells. We then assess the influence of an initial stress field on the non-linear response. Particular consideration is given to the amplification of individual modes by the initial stress field. Author (GRA)

N81-28479# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
STATISTICAL REPRODUCIBILITY OF THE DYNAMIC AND STATIC FATIGUE EXPERIMENTS Technical Report, 1 Oct. 1979 - 1 Oct. 1980
John E. Ritter, Jr. and Karl Jakus Oct. 1980 50 p refs
(Contract N00014-78-C-0836; NR Proj. 039-170)
(AD-A100469) Avail: NTIS HC A03/MF A01 CSCL 11/2

The number of test samples used to characterize the fatigue constants needed for failure predictions for ceramic materials

determines the confidence in these predictions. The statistical reproducibility of the dynamic and static fatigue experiments used to measure the fatigue constants was analyzed using both statistical theory and a Monte Carlo computer simulation technique. It was found that the statistical reproducibility depended not only on the number of test samples but also on the other experimental test variables. It was shown that the uncertainty in the statistical reproducibility can be large especially for sample size less than about 100. Guidelines for selecting the optimum sample size for a given dynamic or static fatigue experiment are given. It is recommended that before meaningful conclusions can be drawn regarding the effect of a test variable on fatigue, the statistical reproducibility of the experiment be determined.
Author (GRA)

N81-28480# Michigan State Univ., East Lansing. Div. of Engineering Research.
AN EXPERIMENTAL STUDY OF LARGE COMPRESSIVE LOADS UPON RESIDUAL STRAIN FIELDS AND THE INTERACTION BETWEEN SURFACE STRAIN FIELDS CREATED BY COLDWORKING FASTENER HOLES Final Report, 1 Jun. 1978 - 15 Feb. 1980
Gary Cloud and Rajab Sulaimana Wright-Patterson AFB, Ohio AFWAL Feb. 1981 235 p refs
(Contract F33615-78-C-5123; AF Proj. 2418)
(AD-A100524; AFWAL-TR-80-4206) Avail: NTIS HC A11/MF A01 CSCL 13/5

This research investigated three related problems, namely: (1) the evaluation of the residual strain redistribution around an initially coldworked fastener hole in a semi-infinite plate subjected to large in-plane compressive loads; (2) the determination of the effects of a near edge of a row of coldworked holes parallel to such an edge, and the possible creation of a strain climate at the straight edge which could lead to stress corrosion problems; and, (3) the interactions of surface strain fields between rivet holes which are being coldworked. The strain distributions were obtained by a moire technique, with the aid of coherent optical processing and digital data reduction. Many useful conclusions about the residual strain fields near coldworked holes were established. GRA

N81-28481# Texas A&M Univ., College Station. Dept. of Mathematics.
FRACTURE MECHANICS OF LINEARLY ELASTIC AND VISCOELASTIC MATERIAL Annual Scientific Report, 1 Apr. 1980 - 31 Mar. 1981
Jay R. Walton 31 Mar. 1981 6 p
(Grant AF-AFOSR-3290-77; AF Proj. 2304)
(AD-A100315; AFOSR-81-0492TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

This report summarizes progress on certain theoretical questions arising in the study of the fracture mechanics of linearly elastic and viscoelastic material. Specifically, two classes of problems are described: (1) Energy release rate calculations for a mode 3 elastic interface edge crack based on the M-conservation integral; and (2) A description of the dynamic stress field ahead of a steadily propagating semi-infinite crack in a general infinite viscoelastic body and in a viscoelastic layer of finite thickness. Both Mode 1 and Mode 3 deformations are considered.
Author (GRA)

N81-28482# Applied Research Association, Inc., Albuquerque, N. Mex.
FULL-SCALE LOAD TESTS OF EXPERIMENTAL SOLAR-COLLECTOR FOUNDATIONS
Douglas H. Merkle Mar. 1981 36 p Presented at the ASCE Spring Conf., Las Cruces, N. Mex., 27 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-7076; CONF-810341-1) Avail: NTIS HC A03/MF A01

Four drilled, reinforced concrete piers, typical of foundations utilized for single axis tracking solar collector systems, were tested to failure under both eccentric lateral and vertical loads. Previously developed equations for lateral and vertical load capacity yielded reasonable predictions, but the tests disclosed the need to improve the foundation anchor bolt assembly, and possibly also the method of mounting the collectors to the foundations. Nevertheless, the lateral and vertical failure loads and moments of all four piers well exceeded specified design values. DOE

N81-28483# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
RESPONSE OF SOLIDS TO ELASTIC/PLASTIC INDENTATION AND THE APPLICATION OF INDENTATION TO ADHESION MEASUREMENTS Ph.D. Thesis
Shu- Sheng Chiang Mar. 1981 144 p refs
(Contract W-7405-eng-48)
(LBL-11841) Avail: NTIS HC A07/MF A01

An approach for analyzing indentation plasticity and indentation fracture is presented. The analysis relates material properties (hardness, yield strength and elastic modulus) and the magnitudes of the indentation and plastic zone. The indentation stress fields are adapted to predict indentation fracture thresholds for the three dominant crack types: radial, median, and lateral cracks. The indentation method was applied to determine the adhesion of interfaces between thin films and substrates. It is concluded that this method provides a quantitative measure of the interface fracture resistance. DOE

N81-28484# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Mechanical Engineering.
THE 3D SIMULATION OF A NOSE CONE CRUSHING
Bruce Eric Brown and John O. Hallquist Apr. 1981 6 p Submitted for publication
(Contract W-7405-eng-48)
(UCRL-85909) Avail: NTIS HC A02/MF A01

The nose cone shown represents cooperative effort between the Department of Energy's Lawrence Livermore and Sandia National Laboratories. Various parts of weapons, such as this stainless steel nose cone, are designed to mitigate kinetic energy when impacting on hard surfaces. A redesign was necessitated when changes in the impact velocity required the nose cone to absorb more energy. DOE

N81-28485# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
ANALYSIS OF STRONG NOCTURNAL SHEARS FOR WIND MACHINE DESIGN Final Report
L. Mahrt and R. C. Heald Nov. 1980 77 p refs
(Contract DE-AT06-79ET-23116)
(DOE/ET-23116/80-1) Avail: NTIS HC A05/MF A01

Wind shear data at wind turbine heights from several sites is reviewed and new data is documented in terms of total and component shear. A variety of atmospheric scenarios may combine to give large persistent shear. Among these, strong boundary layer stability is foremost. It occurs with strong nocturnal surface cooling, in low level frontal and subsidence inversions, and in thunderstorm outflows. Strong shears resulting from surface radiation inversions are evident over the High Plains where dry air and high altitude combine to result in strong radiational cooling. Terrain is also an important influence on shear but it is not well understood and is very site specific. DOE

N81-28486# Southampton Univ. (England). Inst. of Sound and Vibration Research.
POWER TRANSMISSION FROM RIGID AND RESONANT SOURCE VIA ISOLATORS TO RESONANT AND NONRESONANT STRUCTURES
R. J. Pinnington Oct. 1980 101 p refs Sponsored by UK Ministry of Defence
(ISVR-TR-114) Avail: NTIS HC A06/MF A01

The parameters controlling power transmission from a vibrating machine to the seating structure, such as a ship hull via spring-like isolators are investigated. The machine source is modeled by a mass at low frequencies and by a heavily damped beam at higher frequencies. The seating is modeled by both a long finite beam and an infinite beam in both frequency regions. Predictions of frequency average power and peak power transmission are made, using frequency average data of the machine source and seating properties. The theoretical work is verified by experimental measurements using a 50 cm aluminum bar damped with steel sheer and rubber adhesive coupled to a reciever beam by a rubber isolator. Maximum power transmission occurs between the force and velocity source regions, at the resonance frequency of the coupled mass spring and semi-infinite

beam. When the finite beam is a source structure, the transition from rigid body to flexural beam-like behavior occurs when the magnitude of the rigid beam mobility becomes comparible with the real component of mobility of the beam due to flexural motion. Author (ESA)

N81-28487# Oxford Univ. (England). Dept. of Engineering Science.
TENSILE AND SHEAR INSTABILITIES IN TENSILE TESTS ON RODS AND SHEETS
Yilong Bai and Bradley Dodd Oct. 1980 27 p refs
(OUEL-1329/80) Avail: NTIS HC A03/MF A01

Room temperature and cryogenic tensile testing is examined with particular reference to metallographic details. Thermoplastic shear instability is proposed as a mechanism of shear localization in bands in both rod and sheet tensile specimens. It is shown that tensile instability is a result of a blend of thermoplastic and geometrical softening. This is confirmed in the case of sheets, and thermoplastic shear instability seems to be the more likely cause of the initiation of localized necking. Some approaches and explanations of the mechanism of ductile fracture in a rod tensile specimen are suggested. For alpha titanium and a titanium alloy it is shown that thermoplastic shear instability is the predominant factor causing localized necking whereas for Armco iron and 4130 steel the predominant factor is geometrical softening. Materials in which thermoplastic instability is the predominant feature in localizing necking have a low density and a relatively low atomic weight. Author (ESA)

N81-28488# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
AN ASYMPTOTIC THEORY FOR FLEXURAL VIBRATIONS OF CIRCULAR PLATES
A. M. A. vanderHeijden Nov. 1980 66 p refs
(WTHD-130) Avail: NTIS HC A04/MF A01

Starting from the formulation of the initial boundary value problem of the linear theory of elasticity, sets of two dimensional equations with corresponding boundary and initial values are derived by asymptotic expansions in a thickness parameter epsilon. Epsilon is equivalent to h/L, where 2h is the thickness of the plate and L is the minimum wave length of the deformation pattern in the midplane of the plate. Author (ESA)

N81-28489# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE PROPERTIES OF ADHESIVE-BONDED LAMINATED SHEET MATERIAL OF ALUMINUM ALLOYS
J. Schijve, H. T. M. vanLipzig, G. F. J. A. vanGestel, and A. H. W. Hoeymakers Dec. 1978 40 p refs
(VTH-LR-276) Avail: NTIS HC A03/MF A01

Comparative fatigue tests were carried out on centrally cracked specimens and lug type specimens, both made from solid sheet and laminated sheet, consisting of five 1 mm sheets of 2024-T3 Alclad material bonded by FM 123/5. Most tests were carried out under constant amplitude loading, but growth delays due to peak loads were also studied. Cracks through the laminated material as well as cracks only partially through the material are considered. Significance of the results for application in aircraft structures is analyzed. Results indicate that laminated sheet material can significantly improve the damage tolerance quality of an aircraft structure. Author (ESA)

N81-28490# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
THE EFFECT OF ENVIRONMENT ON THE TRANSITION FROM TENSILE MODE TO SHEAR MODE DURING FATIGUE CRACK GROWTH IN ALUMINUM ALLOYS. A MODEL FOR ENVIRONMENTALLY ASSISTED CRACK GROWTH
L. B. Vogelesang Oct. 1979 31 p refs
(VTH-LR-286) Avail: NTIS HC A03/MF A01

Fatigue crack propagation tests were carried out in different environments on 7075-T6 and 2024-T3 center-cracked sheet specimens. Observations were made on the transition from tensile mode to shear mode. It is shown that there is no unique correlation between the state of stress and the mode of cracking. Together with the state of stress the environment has a significant effect on the mode of cracking. The implications for crack growth under corrosion fatigue conditions as well as the fatigue mechanism are discussed. Author (ESA)

N81-28491# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
THE INITIAL IMPERFECTION DATA BANK AT THE DELFT UNIVERSITY OF TECHNOLOGY, PART 1
J. Arbocz and H. Abramovich Dec. 1979 201 p refs
(VTH-LR-290-Pt-1) Avail: NTIS HC A10/MF A01

The results of the initial imperfection surveys of 35 circular cylindrical shells of different makes and sizes are presented. Three-dimensional plots show that the shapes of the measured initial imperfections are clearly influenced by details of the shell construction. The modal components of the measured imperfection surfaces as a function of the circumferencial and axial wave numbers are calculated. Characteristic imperfection distributions associated with the different manufacturing processes used to make the shells are displayed. Author (ESA)

N81-28492# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
EFFECTS OF CRACK LENGTH ON (K SUB Q) VALUES OF ALUMINIUM 7075 T651 CT-SPECIMENS
H. F. deJong Feb. 1980 23 p refs
(VTH-LR-294) Avail: NTIS HC A02/MF A01

Fracture toughness tests were caried out on compact tension (CT) specimens of aluminium 7075 T651. The influence of the crack length ratio on the critical stress intensity factor was investigated. The results show that there is probably no, or only a minor influence due to the crack length ratio in the investigated range of crack length ratios (about $0.35 < a/W < 0.75$). However, the results were affected by the fatigue crack surface geometry. This effect is also studied and its influence on the critical stress intensity factor is discussed. Author (ESA)

N81-28493# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
FATIGUE CRACK GROWTH IN 7475-T7651 MATERIAL UNDER FLIGHT SIMULATION LOADING. INFORMATION FROM A DOUGLAS REPORT
J. Schijve Jan. 1980 11 p refs
(VTH-M-392) Avail: NTIS HC A02/MF A01

The results of an extensive investigation on crack propagation in aluminum alloy sheet material under flight simulation loading are summarized. The effets of various modifications in load spectra on crack growth were studied. One hundred and sixteen different flight simulation load histories were generated and then used for crack growth predictions based on linear damage accumulation. The load histories represent possible load spectra for the wing lower surface of a STOL transport (C-15). Tests were carried out with thirty-three histories in order to verify the predictions. The experimental data is synthesized; interesting trends are identified, and the significance of the results, especially for verification of crack growth prediction methods, is discussed. The effects of material thickness, multiple overloads, design stress level and minimum stress range applied in the test are described. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-28494 California Univ., Los Angeles.
THE FEASIBILITY OF USING SILVICULTURAL BIOMASS

AS AN ALTERNATE FUEL: THE HANFORD RESERVATION CASE STUDY Ph.D. Thesis
John Isaac Baum 1981 153 p
Avail: Univ. Microfilms Order No. 8113815

An integrated silvicultural biomass plantation and infrastructure capable of producing a renewable supply of wood pellets. The capacity of the system is intended to replace the 78,000 metric tons per year (86,000 short tons per year) of coal currently used at the U.S. Department of Energy Richland Operation site (Hanford Reservation). The proposed 4,860 hectare (12,000 acre) plantation is located on the Hanford Reservation, adjacent to the Columbia River. The biomass plantation would be used for producing rapid growing hybrid Poplar trees, which would be intensely managed and harvested on a six year rotation cycle. Research, storage, transportation, and pelletizing facilities are also included in this concept. Results of the study indicate that it is technically feasible to design an integrated silvicultural/wood pelletizing facility at Hanford. As proposed, the plantation would require a large capital-intensive irrigation system. Based on a discounted cummulative net benefit analysis, the project will show a positive cash flow after 18 years. The net energy analysis indicate that six times more energy is produced than is utilized by the silvicultural plantation (i.e., 84 percent efficiency), which includes direct and indirect energy inputs. The environmental impact analysis indicates that there will be minimal adverse impacts. The major impact will be from the emission of small particulate matter from burning the wood (i.e., less than 10 microns). Overall, the net environmental impacts will be less than the coal, which is currently being used. Dissert. Abstr.

N81-28495 Rochester Univ., N. Y.
THE EFFECTS OF URBANIZATION ON SMALL WATERSHEDS AND GROUND WATER Ph.D. Thesis
Richard Laurence Davis 1980 374 p
Avail: Univ. Microfilms Order 8113608

The effects of development on small streams and ground water was examined. The causes of the changes that took place in the streams and ground water were considered and the possible effects that future development might have were examined. The implications of these changes for the region surrounding Irondequoit Bay were considered. Finally, some strategies for dealing with these effects were considered. Ground water levels and chloride ion concentrations, stream discharges and chloride ion concentrations, were measured. Chloride ion was selected for analysis because of the extensive use of de-icing salt on the roads. The ground water quality data collected was analyzed by comparing it to data from the 1930's, by comparing groups of wells in rural and urban parts of the town, and by comparing wells grouped by their distance to the nearest road. The implications suggested by the results included the likelihood of a substantial decrease in quality of the water supply, and by extension, decreased water quality for the entire aquifer.
Dissert. Abstr.

N81-28496*# Science and Education Administration, Phoenix, Ariz. Water Conservation Lab.
HAND-HELD RADIOMETRY: A SET OF NOTES DEVELOPED FOR USE AT THE WORKSHOP OF HAND-HELD RADIOMETRY
Ray D. Jackson, Paul J. Pinter, Jr., Robert J. Reginato, and Sherwood B. Idso, Principal Investigators Oct. 1980 75 p refs Workshop held at Phoenix, Ariz., 25-26 Feb. 1980 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development ERTS
(Proj. AgRISTARS)
(E81-10163; NASA-CR-160986; EW-U1-04052; JSC-17118)
Avail: NTIS HC A04/MF A01 CSCL 02C

A set of notes was developed to aid the beginner in hand-held radiometry. The electromagnetic spectrum is reviewed, and pertinent terms are defined. View areas of multiband radiometers are developed to show the areas of coincidence of adjacent bands. The amounts of plant cover seen by radiometers having different fields of view are described. Vegetation indices are derived and discussed. Response functions of several radiometers are shown and applied to spectrometer data taken over 12 wheat plots, to provide a comparison of instruments and bands within and among instruments. The calculation of solar time is reviewed and applied to the calculation of the local time of LANDSAT satellite overpasses for any particular location in the Northern Hemisphere. The use and misuse of hand-held infrared thermometers are discussed, and a procedure for photographic determination of plant cover is described. Some suggestions are offered concerning procedures to be followed when collecting hand-held spectral and thermal data. A list of references pertinent to hand-held radiometry is included. A.R.H.

N81-28497*# Department of Agriculture, Houston, Tex.
LARGE AREA APPLICATION OF A CORN HAZARD MODEL
Pat Ashburn and T. W. Taylor, Principal Investigators Mar. 1981 15 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E81-10164; NASA-CR-160985; EW-UL-04074; JSC-17130)
Avail: NTIS HC A02/MF A01 CSCL 02C

An application test of the crop calendar portion of a corn (maize) stress indicator model developed by the early warning, crop condition assessment component of AgRISTARS was performed over the corn for grain producing regions of the U.S.S.R. during the 1980 crop year using real data. Performance of the crop calendar submodel was favorable; efficiency gains in meteorological data analysis time were on a magnitude of 85 to 90 percent. Author

N81-28498*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
A TEMPORAL/SPECTRAL ANALYSIS OF SMALL GRAIN CROPS AND CONFUSION CROPS
W. R. Johnson, Principal Investigators Mar. 1981 76 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10167; NASA-CR-160983; SR-L1-04054; LEMSCO-15676; JSC-17128) Avail: NTIS HC A05/MF A01 CSCL 02C

Spectral data from the LANDSAT-2 satellite were used to study the growth cycles of fields of wheat, barley, alfalfa, corn, sunflowers, soybeans, rye, flax, oats, millet, grass, and hay. Signatures of pastures, trees, and idle fallow were also studied. The growth cycles were portrayed in the form of temporal plots of the greeness-brightness transformation vector applied to average channel pixel values within the fields, all of which were in three counties in North Dakota. The plots of each crop reveal characteristics which can be used in crop classification procedures. A.R.H.

N81-28499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF FOREST CANOPY CLOSURE ON INCOMING SOLAR RADIANCE
C. Lisette Dottavio, Principal Investigator Apr. 1981 29 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Proj. AgRISTARS)
(E81-10170; NASA-TM-82113; RR-G1-04085) Avail: NTIS HC A03/MF A01 CSCL 02F

In order to better understand the physical processes involved in defoliation assessment from remotely sensed data, a field study was designed to investigate the effect of forest canopy closure and other environmental variables on incoming solar radiation. Diffuse radiation measurements were recorded in red, infrared, and middle infrared wavelengths using the Mark 2 three band field radiometer. Results to date indicate that the percent canopy closure is the single most important variable affecting incoming solar radiation. In the visible and near infrared regions, interaction between time of day and date (defined later as solar zenith angle) also affect radiometric response. Aspect has only limited influence on radiance response. These same variables do not influence middle infrared response, however. Uniformity of the forest canopy appears to be more important. These results are compared to LANDSAT MSS classification results of gypsy moth defoliation. A.R.H.

N81-28500# Texas Univ. at Arlington. Center for Energy Studies.
EASTERN EUROPE'S RESOURCE CRISIS, WITH SPECIAL EMPHASIS ON ENERGY RESOURCES: DEPENDENCE AND POLICY OPTIONS
George W. Hoffman Jan. 1981 66 p refs
(Policy-Study-14) Avail: NTIS HC A04/MF A01

The impact of Eastern Europe's energy resource shortages on its future economic and political development and its dependence on the Soviet Union as its main source of supply is examined. Tables show domestic production, imports, exports, and consumption for Bulgaria, Czechoslovakia, the GDR, Hungary, Poland, and Romania. A.R.H.

N81-28501# Texas Univ. at Arlington. Center for Energy Studies.
OFFSHORE OIL: AN OVERVIEW
Ian R. Manners Jun. 1980 110 p refs
(Policy-Study-11) Avail: NTIS HC A06/MF A01

The decline of traditional offshore oil producing regions and the emergence of newer regions is discussed as well as techniques for deepwater production and offshore exploration. The mobile rig fleet, outer continental shelf frontiers, and exploration licensing are discussed. The hydrocarbon potential of seven nations lying outside the major offshore producing regions of the Middle East, the North Sea, and the United States is assessed. The countries profiled are Australia, Argentina, Brazil, Chile, India, Indonesia, and Mexico. A.R.H.

N81-28502# Texas Univ. at Arlington.
THE BANKING OF LIGNITE LEASES IN BASTROP COUNTY, TEXAS: 1954 - 1979
Christopher S. Davies and R. Wyatt Dietrich Aug. 1980 63 p refs
(Policy-Study-12) Avail: NTIS HC A04/MF A01

The forces that produce the pattern of lignite leasing and the effects of these contracts on the landowners and energy companies of Bastrop County are described. Disparities extraction costs, selling price, and the profits of companies and landowners are examined, as well as in the amounts allocated for aesthetic and functional rehabilitation of the landscape despoiled by strip mining. The attitude of landowners towards lignite mining were obtained by questionnaire and are analyzed using two- and three-stage models. The data presented attests to the unbalanced nature of the gains distribution resulting from lignite extraction and lend support to the idea that the energy companies should make a greater contribution to the rehabilitation of the land. A.R.H.

N81-28503# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Aerospace Cartography Dept. Techniques Office.
DIGITAL IMAGE TECHNOLOGY: CARTOGRAPHIC SYSTEMS AT THE DEFENSE MAPPING AGENCY AEROSPACE CENTER Interim Report, May 1979 - Apr. 1981
Marshall B. Faintich 1981 15 p refs Presented at the SPIE Tech. Symp., San Diego, Calif., 24-28 Aug. 1981
(AD-A100354) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Defense Mapping Agency Aerospace Center has developed a program to exploit digital image technology for the advancement of mapping, charting, and geodesy. Primary investigations include image processing, analysis, and display techniques, and computer image generation. A dramatic impact has been made in the ability to produce, analyze, and validate digital data bases produced by the Defense Mapping Agency by applying state-of-the-art digital image technology concepts to the development of new interactive prototype and production cartographic systems. Author (GRA)

N81-28504# Image Graphics, Inc., Fairfield, Conn.
RECORDING AND SCANNING ADVANCES IN CARTOGRAPHIC EBR SYSTEMS Final Report
Patrick F. Grosso and Andrew A. Tarnowski Fort Belvoir, Va. Army Engineer Topographic Labs. Jun. 1981 52 p refs
(Contract DAAK70-77-C-0211)
(AD-A100498; Rept-4005; ETL-0265) Avail: NTIS HC A04/MF A01 CSCL 08/2

The experimental model Cartographic EBR System developed for USAETL in 1977 was modified to include a number of advance hardware and software features: a Symbol/Vector Generator for plotting cartographic and names data; a Raster Scan Translator for recording continuous tone images; a scanning capability; a multiformal and size control; and other improvements. Author (GRA)

N81-28505# California Univ., Los Angeles. Lab. of Biomedical and Environmental Sciences.
VEGETATION MANAGEMENT AND RECOVERY AT SITES DISTURBED FOR SOLAR THERMAL POWER SYSTEMS DEVELOPMENT Progress Report
E. M. Romney, R. B. Hunter, and A. Wallace Feb. 1981 25 p refs
(Contract DE-AC03-76SF-00012)
(UCLA-12-1281) Avail: NTIS HC A02/MF A01

Disturbing land to develop energy producing technologies in Mojave Desert areas usually destroys existing shrub vegetation that cannot be repaired by natural restoration processes within the time frame required by environmental protection legislation. The primary effort of the vegetation management project during FY 1980 was directed toward the development of cost effective methods of restoring native vegetation on disturbed Mojave Desert land. Emphasis was placed upon improving techniques for producing transplanting stocks of native shrub species, investigating different ways to protect and encourage regrowth from crown sprouting and new seedling germination, developing improved transplanting methods, and searching for more practical means of conserving seasonal soil moisture necessary for the survival of new plant seedlings and transplanted specimens. DOE

N81-28506# Los Alamos Scientific Lab., N. Mex.
DRAINAGE FLOW OVER COMPLEX TERRAIN
C. G. Davis, S. S. Bunker, D. S. King, J. P. Mutschlecner, S. Barr, and W. E. Clements 1981 4 p refs Presented at the 5th Symp. on Turbulence, Diffusion, and Air Pollution, Atlanta, 9-13 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3052; CONF-810306-1) Avail: NTIS HC A02/MF A01

Model calculations even carried in order to simulate tracer release experiments at the Geysers Area. Comparisons with the experimental data provide a test of current ability to model pollutant transport. The calculations were carried out with a windfield code (ATMOS1) and an advection-diffusion code (ATMOS2). The resulting concentrations permit prediction of tracer particle collections at the measurement stations. Comparison of the observations and predictions of sequential and integrated counts shows generally good agreement, but with discrepancies in some instances. The method appears to be a useful one for pollutant transport predictions and for parametric studies. DOE

N81-28507# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF AREAL SEISMICS TO MAPPING SANDSTONE CHANNELS
T. L. Dobecki 1981 32 p refs Presented at the Joint SPB/DOE Symp., Denver, 27 May 181
(Contract DE-AC04-76DP-00789)
(SAND-81-0387C; CONF-810518-2; SPB/DOE-9847) Avail: NTIS HC A03/MF A01

State-of-the-art seismic reflection methods as a means of mapping the subsurface configuration of low permeability sandstone channels (potential gas reservoirs typical of Tertiary and Cretaceous formations) were evaluated. A computer model study was performed to predict the effectiveness of seismic techniques applied to such targets and criteria for interpreting real data were developed and a seismic field experiment was designed to test and evaluate the ability to map known lenses. Through the lessons learned by seismic modeling, it was possible to interpret field seismic data in terms of channeling and thereby predict the orientation of channels in the subsurface. Projecting these channels out of the area of seismic coverage in order to predict their outcrop position; existing channels which agree quite well with the seismic description and projection were located. DOE

N81-28508# Adams (Samuel S.) and Associates, Boulder, Colo.
GEOLOGY AND RECOGNITION CRITERIA FOR URANIFEROUS HUMATE DEPOSITS, GRANTS URANIUM REGION,

NEW MEXICO Final Report
S. S. Adams and A. E. Saucier (SEDI-MET, Inc., Albuquerque, N. Mex.) Jan. 1981 306 p refs Prepared for Bendix Field Engineering Corp., Grand Junction, Colo.
(Contract DE-AC13-76GJ-01664)
(GJBX-2(81)) Avail: NTIS HC A14/MF A01

The geology of the uraniferous humate uranium deposits of the Grants Uranium Region, northwestern New Mexico, summarized. The geologic characteristics of the uraniferous humate deposits of the Grants Uranium Region are not common in the world, neither are they bizarre or coincidental. The influence of structural control on the location and accumulation of the host sediments is supported considerable data. The host sediments possess numerous important characteristics which influenced the formation of uraniferous humate deposit. Ilmenite magnetite distribution within potential host sandstones is the simplest and most useful regional alteration pattern related to this type of uranium deposit. A method is presented for organizing geologic observation into recognition criteria. It is concluded that the potential of the United States for new districts similar to the Grants Uranium Region is low. DOE

N81-28509# Science Applications, Inc., Morgantown, W. Va.
QUANTITATIVE ANALYSIS OF THE ECONOMICALLY RECOVERABLE RESOURCE
C. V. Pulle and A. P. Seskus May 1981 108 p refs
(Contract DE-AM21-78MC-08216)
(DOE/MC-08216-157) Avail: NTIS HC A06/MF A01

Economically recoverable gas in the Appalachian Basin. Estimates were obtained for a probability distribution, associated with estimates where geologic and production uncertainties prevail. Well productivity on a county and regional basis is lognormally distributed, and the total recoverable gas is normally distributed. With smaller well spacings the estimate is substantially increased, and advanced technology, such as foam fracturing, has the potential of significantly increasing gas recovery. The lognormal distribution of well productivity even in smaller areas, of intense exploration appropriate. The lognormal distribution, represents the small number of wells with relatively very high productivity. DOE

N81-28510# Georgia Marine Science Center, Savannah.
A COMPUTER PROGRAM FOR THE GRAPHIC DISPLAY AND QUANTITATIVE EVALUATION OF BEACH PROFILE DATA
C. F. Chamberlain (Fugro Inc., Long Beach, Calif.), M. C. Larsen (Geological Survey, Menlo Park, Calif.), and G. F. Oertel (Old Dominion Univ.) 1980 16 p refs
(PB81-128050; TR-80-4; NOAA-80102702) Avail: NTIS HC A02/MF A01 CSCL 08B

The program, written for a Hewlett-Packard desk top Calculator (Model 9825) - Plotter (Model 9862A), displays a graphic plot of beach face elevation data and quantifies the area under the beach profile. The data input required by the program includes: an elevation at the profile origin, the change in elevation measurements along the profile and the distance between elevation measurements. GRA

N81-28120# Joint Publications Research Service, Arlington, Va.
USE OF SATELLITE PICTURES FOR AGRICULTURE
D. Gergishvili *In its* USSR Rept.: Space, No. 9 (JPRS-77388) 2 Mar. 1981 p 26-27 refs Transl. into ENGLISH from Komunisti (USSR), 24 Jul. 1980 p 4 (For primary document see N81-28115 19-12)
Avail: NTIS HC A03/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-28511 Purdue Univ., Lafayette, Ind.
ANALYTICAL AND EXPERIMENTAL STUDY OF UNDERGROUND COMPRESSED AIR ENERGY STORAGE Ph.D. Thesis
Kuan-Horng Lee 1980 111 p
Avail: Univ. Microfilms Order No. 8113713

The flow equation for a varying-thickness, irregular boundary, and multiwell aquifer reservoir is formulated by a two dimensional analysis. The alternating direction implicit method is employed to solve the flow equation. Coupling between the aquifer reservoir and the aboveground rotating machinery is implemented by a hybrid bisection secant iteration scheme. The aquifer reservoir is also simulated by a continuous electric analog experiment Computational results from the numerical calculation are compared with the experimental results. Results from a sample calculation of a ten-well reservoir are presented to demonstrate the interwell interference. Finally, the accuracy of the numerical computation is also verified by the principle of mass conservation. Dissert. Abstr.

N81-28512 Miami Univ., Fla.
PRINCIPLES OF MANAGEMENT OF MUNICIPAL SOLID WASTE ANAEROBIC BIOCONVERSION FACILITIES Ph.D. Thesis
Jairo Francisco Lascarro 1980 159 p
Avail: Univ. Microfilms Order No. 8114776

A full scale proof of concept plant for the anaerobic conversion of municipal solid waste to methane rich gas was constructed in Pompano Beach, Florida. This facility provided the opportunity to develop baseline management principles and to improve the understanding of this technology. Engineering data and technical concepts were derived from the operation of this plant with a view that it will help in resolving the uncertainties related with this process. Some of the fundamental problems associated with the technical operation of this process are investigated. A summary of economic data is included to emphase those factors which might affect the future development of this technology. Some of the major federal acts associated with this technology are listed to anticipate issues that may hinder the smooth progress of this technology. Dissert. Abstr.

N81-28513 Purdue Univ., Lafayette, Ind.
DAMPING CONTROL OF POWER SYSTEMS WITH MAGNETIC ENERGY STORAGE Ph.D. Thesis
Nanming Chen 1980 119 p
Avail: Univ. Microfilms Order No. 8113655

The power system dynamic instability problem on the Pacific AC/DC Intertie was solved by modulating the converter power of the HVDC tie line. An alternate control approach using magnetic energy storage is explored for more general power systems without HVDC lines. Dynamic equivalents of power systems are first formulated using a component connection model to serve as the basis of a eigenvalue study. The unstable modes of such a linearized power system are factored out and eigenvalue assignment through state feedback is performed. The state feedback gains obtained herefrom are then transformed back into the original system. These gains suggest the use of output feedback using the rates of AC power changes on transmission lines. A Least Squares approximation of the state feedback gains ensables the control signals to be obtained by local output feedback. The limits of the converter control voltage may be imposed on the output feedback signals to determine the size of the energy storage unit required. Dissert. Abstr.

N81-28514 Purdue Univ., Lafayette, Ind.
NUMERICAL ANALYSIS OF SILICON SOLAR CELLS Ph.D. Thesis
Mark Steven Lundstrom 1980 176 p
Avail: Univ. Microfilms Order No. 8113719

A set of equations which describes the physics of modern, high efficiency silicon solar cells is formulated and solved numerically. Transport equations for use in analyzing heavily doped semiconductor devices are considered. These transport equations describe the effects of the nonuniform band structure and the influence of Fermi-Dirac statistics, which are important in heavily doped semiconductors. A semiconductor device is described mathematically by Poisson's equation and two current continuity equations. Using the transport equations developed, these equations were solved numerically in one dimension. The accuracy of the model was tested by comparing the results of computer calculations to exact analytical results (for certain simple cases) and to experimental results. The model was shown to accurately describe high efficiency silicon solar cells under a wide range of operating biases and for solar concentrations that varied from 1 to 250. Dissert. Abstr.

N81-28515*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR DOMESTIC HOT WATER SYSTEM MANUAL FOR DAY'S INN, GARLAND, TEXAS Final Report
May 1981 36 p refs Sponsored in part by NASA
(Grant EG-77-G-01-1632)
(NASA-CR-161802) Avail: NTIS HC A03/MF A01 CSCL 10A

The Solar Domestic Hot Water System installed at Day's Inn, I-30 and 6222 Beltline, Garland, Texas, is described. The system is a solar collector array used to provide from 39.9 percent in December, to 84.7 percent in August, of the domestic hot water usage of the Day's Inn in Garland, Texas. The system is an automatic draindown design employing an atmospheric vented storage tank for storing the hot water collected by the 998 sq. ft. collector array. S.F.

N81-28516*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
MOD-0A 200 kW WIND TURBINE GENERATOR DESIGN AND ANALYSIS REPORT Final Report
T. S. Anderson, C. A. Bodenschatz, A. G. Eggers, P. S. Hughes, R. F. Lampe, M. H. Lipner, and J. R. Schornhorst Aug. 1980 394 p refs
(Contracts DE-AB29-76ET-20370; DEN3-163)
(NASA-CR-165128; DOE/NASA/0163-2; AESD-TME-3052) Avail: NTIS HC A17/MF A01 CSCL 10B

The design, analysis, and initial performance of the MOD-0A 200 kW wind turbine generator at Clayton, NM is documented. The MOD-0A was designed and built to obtain operation and performance data and experience in utility environments. The project requirements, approach, system description, design requirements, design, analysis, system tests, installation, safety considerations, failure modes and effects analysis, data acquisition, and initial performance for the wind turbine are discussed. The design and analysis of the rotor, drive train, nacelle equipment, yaw drive mechanism and brake, tower, foundation, electrical system, and control systems are presented. The rotor includes the blades, hub, and pitch change mechanism. The drive train includes the low speed shaft, speed increaser, high speed shaft, and rotor brake. The electrical system includes the generator, switchgear, transformer, and utility connection. The control systems are the blade pitch, yaw, and generator control, and the safety system. Manual, automatic, and remote control are discussed. Systems analyses on dynamic loads and fatigue are presented. J.M.S.

N81-28517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN DESCRIPTION OF THE SCHUCHULI VILLAGE PHOTOVOLTAIC POWER SYSTEM Final Report
Anthony F. Ratajczak, Richard W. Vasicek, and Richard DeLombard May 1981 100 p
(Contract DE-AI01-79ET-20485)
(NASA-TM-82650; DOE/NASA/20485-10) Avail: NTIS HC A05/MF A01 CSCL 10B

A stand alone photovoltaic (PV) power system for the village of Schuchuli (Gunsight), Arizona, on the Papago Indian Reservation is a limited energy, all 120 V (d.c.) system to which loads cannot be arbitrarily added and consists of a 3.5 kW (peak) PV array, 2380 ampere-hours of battery storage, an electrical equipment building, a 120 V (d.c.) electrical distribution network, and equipment and automatic controls to provide control power for pumping water into an existing water system; operating 15 refrigerators, a clothes washing machine, a sewing machine, and lights for each of the homes and communal buildings. A solar hot water heater supplies hot water for the washing machine and communal laundry. Automatic control systems provide voltage control by limiting the number of PV strings supplying power during system operation and battery charging, and load management for operating high priority at the expense of low priority loads as the main battery becomes depleted. A.R.H.

N81-28518*# Arlington Racquetball Club Associates, Va.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT ARLINGTON RAQUETBALL CLUB, ARLINGTON, VIRGINIA Final Report
May 1981 97 p
(Contract EM-78-F-01-5211)
(NASA-CR-161797) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar space and water heating system is described. The solar energy system consists of 2,520 sq. ft. of flat plate solar collectors and a 4,000 gallon solar storage tank. The transfer medium in the forced closed loop is a nontoxic antifreeze solution (50 percent water, 50 percent propylene glycol). The service hot water system consists of a preheat coil (60 ft. of 1 1/4 in copper tubing) located in the upper third of the solar storage tank and a recirculation loop between the preheat coil and the existing electric water heaters. The space heating system consists of two separate water to air heat exchangers located in the ducts of the existing space heating/cooling systems. The heating water is supplied from the solar storage tank. Extracts from site files, specification references for solar modifications to existing building heating and hot water systems, and installation, operation and maintenance instructions are included. M.G.

N81-28519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PUMPING POWER CONSIDERATIONS IN THE DESIGNS OF NASA-REDOX FLOW CELLS Final Report
Mark A. Hoberecht Jun. 1981 12 p refs
(Contract DE-AI04-80AL-12726)
(NASA-TM-82598; DOE/NASA/12726-7) Avail: NTIS HC A02/MF A01 CSCL 10C

Pressure drop data for six different cell geometries of various flow port, manifold, and cavity dimensions are presented. The redox/energy/storage system uses two fully soluble redox couples as anode and cathode fluids. Both fluids are pumped through a redox cell, or stack of cells, where the electrochemical reactions take place at porous carbon felt electrodes. Pressure drop losses are therefore associated with this system due to the continuous flow of reactant solutions. The exact pressure drop within a redox flow cell is directly dependent on the flow rate as well as the various cell dimensions. Pumping power requirements for a specific set of cell operating conditions are found for various cell geometries once the flow rate and pressure drop are determined. These pumping power requirements contribute to the overall system parasitic energy losses which must be minimized, the choice of cell geometry becomes critical. E.D.K.

N81-28520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PHOTOVOLTAIC CELL TEMPERATURES IN MODULES OPERATING WITH EXPOSED AND ENCLOSED BACK SURFACES Final Report
David Namkoong and Frederick F. Simon May 1981 21 p refs
(Contract De-AI01-79ET-20485)
(NASA-TM-81769; DOE/NASA/20485-9; E-831) Avail: NTIS HC A02/MF A01 CSCL 10C

Four different photovoltaic module designs were tested to determine the cell temperature of each design. The cell temperatures were compared to those obtained on identical design, using the same nominal operating cell temperature (NOCT)

concept. The results showed that the NOCT procedure does not apply to the enclosed configurations due to continuous transient conditions. The enclosed modules had higher cell temperatures than the open modules, and insulated modules higher than the uninsulated. The severest performance loss - when translated from cell temperatures - 17.5 % for one enclosed, insulated module as a compared to that module mounted openly. E.A.K.

N81-28521*# Belz Investment Co., Memphis, Tenn.
SOLAR HEATING SYSTEM INSTALLED AT BELZ INVESTMENT COMPANY, MEMPHIS, TENNESSEE Final Report
Jun. 1981 100 p refs Sponsored in part by NASA
(Contract EM-78-F-01-5210)
(NASA-CR-161803) Avail: NTIS HC A05/MF A01 CSCL 10A

A hot air solar system which utilizes flat plate air collectors is discussed. Collector areas for each of four buildings cover 780 sq ft, with storage capacity of 390 cu ft per building. The air system has a special air handling unit to move air through the collectors and into and out of the rock storage, with connection to the air duct distribution system. The heat of the motor is added to the heat delivered to the system. The solar system also includes four motorized special low leakage dampers and two gravity fabric dampers. The system is automatically controlled by a solid state controller with three thermistors: one located in the collectors, one in the rock box to plenum, one in the return air duct from the heated space. A three stage heating thermostat, located in the conditioned space, controls the operation. E.A.K.

N81-28522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF INTEGRATED GASIFIER-COMBINED CYCLE AND AFB-STEAM TURBINE SYSTEMS FOR INDUSTRIAL COGENERATION
Joseph J. Nainiger, John M. Abbott, and Raymond K. Burns 1981 27 p refs Presented at 16th Intersoc. Energy Conversion Engl. Conf., Atlanta, 9-14 Aug. 1981; sponsored by ASME
(NASA-TM-82648; E-906) Avail: NTIS HC A03/MF A01 CSCL 10B

In the cogeneration technology alternatives study (CTAS) a number of advanced coal fired systems were examined and systems using a integrated coal gasifier IGCC or a fluid bed combustor AFB were found to yield attractive cogeneration results in industrial cogeneration applications. A range of site requirements and cogeneration sizing strategies using ground rules based on CTAS were used in comparing an IGCC and an AFB. The effect of time variations in site requirements and the sensitivity to fuel and electricity price assumptions are examined. The economic alternatives of industrial or utility ownership are also considered. The results indicate that the IGCC system has potentially higher fuel and emission savings and could be an attractive option for utility ownership. The AFB steam turbine system has a potentially higher return on investment and could be attractive assuming industrial ownership. A.R.H.

N81-28523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION, PERFORMANCE, AND PREDICTION OF A LEAD-ACID BATTERY UNDER SIMULATED ELECTRIC VEHICLE DRIVING REQUIREMENTS Final Report
John G. Ewashinka and John M. Bozek May 1981 26 p refs
(Contract DE-AI01-77CS-51044)
(NASA-TM-81771; DOE/NASA/51044-19; E-717) Avail: NTIS HC A03/MF A01 CSCL 10C

A state-of-the-art 6-V battery module in current use by the electric vehicle industry was tested at the NASA Lewis Research Center to determine its performance characteristics under the SAE J227a driving schedules B, C, and D. The primary objective of the tests was to determine the effects of periods of recuperation and long and short periods of electrical regeneration in improving the performance of the battery module and hence extendng the vehicle range. A secondary objective was to formulate a computer program that would predict the performance of this battery module for the above driving schedules. The results show excellent correlation between the laboratory tests and predicted results. The predicted performance compared with laboratory tests was within +2.4 to -3.7 percent for the D schedule, +0.5 to -7.1 percent for the C schedule, and better than -11.4 percent for the B schedule. Author

N81-28524*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR THERMAL POWER SYSTEMS PARABOLIC DISH PROJECT Annual Technical Report
V. C. Truscello 15 May 1981 94 p refs Prepared in cooperation with JPL, California Inst. of Technology, Pasadena
(Contracts NAS7-100; DE-AT04-81AL-16228)
(NASA-TM-82371; JPL-PUB-81-39; DOE/JPL-1060-45) Avail: NTIS HC A05/MF A01 CSCL 10A

The status of the Solar Thermal Power Systems Project for FY 1980 is summarized. Included is: a discussion of the project's goals, program structure, and progress in parabolic dish technology. Analyses and test results of concentrators, receivers, and power converters are discussed. Progress toward the objectives of technology feasibility, technology readiness, system feasibility, and system readiness are covered. E.A.K.

N81-28525# Committee on Science and Technology (U. S. House).
OVERSIGHT: WESTERN SOLAR ENERGY ACTIVITIES
Washington GPO 1980 130 p refs Hearing before the Subcomm. on Energy Develop. and Applications of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 123, 3 Jan. 1980
(GPO-63-657) Avail: Subcommittee on Energy Development and Applications

Development and commercialization of solar energy technology is discussed with regard to the case of California, which leads the other States in its encouragement of solar incentives. The operation of the Western Sun Solar Center, one of four regional solar centers of DOE with responsibility for commercialization, is assessed. S.F.

N81-28526# Committee on Science and Technology (U. S. House).
OCEAN THERMAL ENERGY CONVERSION
Washington GPO 1980 71 p refs Hearing on H.R. 7474 before the Subcomm. on Energy Develop. and Applications of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 163, 5 Jun. 1980
(GPO-70-807) Avail: Subcommittee on Energy Development and Applications

The Ocean Thermal Energy Conversion Research and Development Act is assessed in terms of the need for legislation. Pilot plant planning, heat exchanges test, commercialization, and potential resources are discussed. S.F.

N81-28527# Committee on Science and Technology (U. S. House).
OVERSIGHT: SOLAR PHOTOVOLTAIC PROGRAM
Washington GPO 1980 164 p Hearing before the Subcomm. on Energy Develop. and Applications of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 135, 29 Feb. 1980
(GPO-64-863) Avail: Subcommittee on Energy Development and Applications

Public Law 95-590, the Solar Photovoltaic Energy Systems Research Development and Demonstration Act of 1978, is reviewed, along with the Department of Energy's implementation of the 10 year photovoltaic program. Controversy settles on DOE's emphasis on research and development to the detriment of marketing development and demonstration. S.F.

N81-28528# Real Estate Research Corp., Washington, D.C.
RESIDENTIAL SOLAR DEMONSTRATION PROGRAM: FINDINGS OF THE PASSIVE SOLAR RESIDENTIAL DESIGN COMPETITION AND DEMONSTRATION
1980 84 p
Avail: NTIS HC A05/MF A01

The survey consists of 25 speculative (for sale) houses and 17 custom homes, of which about one-half are 'contractor-built' and the other half are 'owner-built'. The typical passive house surveyed is a modern, single-family detached home with a wood exterior; three bedrooms; one to two baths; garage; and no basement. The design and construction of these homes are

discussed along with the marketing of passive solar houses. A profile was generated of the passive home purchaser. T.M.

N81-28529# Army Construction Engineering Research Lab., Champaign, Ill.

TECHNOLOGIES FOR ENERGY FROM BIOMASS BY DIRECT COMBUSTION, GASIFICATION, AND LIQUEFACTION Final Report

A. Collishaw May 1981 98 p refs

(Contracts DACA88-79-M-0111; DAVA88-79-M-0110; DA Proj. 4A6-2731-AT-41)

(AD-A100323; CERL-TR-E-172) Avail: NTIS HC A05/MF A01 CSCL 10/1

This study appraises the technologies available to produce energy from biomass (wood). Direct combustion, gasification, and liquefaction methods are discussed as they relate to Army-scale (3 to 250 million MBtu/hr .88 to 73 MW) central heating plants. The study found: (1) There is little economic data for energy-from-wood technologies however, ranges of anticipated costs are given. (2) Combustion-based wood fuel technology is well established in this country. Of the five types reported, spreader-stoker and fluidized bed combustors are the most advanced. (3) While not as advanced as combustion-based wood fuel technology, wood gasification/liquefaction technologies are expected to emerge as demonstrated technologies in the near term. It is recommended that Army planners consider, and if the economics are favorable, submit wood-fueled, combustion-based heating plants as part of the normal Military Construction program for 1983 through 1988. Author (GRA)

N81-28530# Oak Ridge National Lab., Tenn.

FOSSIL ENERGY PROGRAM Progress Report for November 1980

L. E. McNeese Jan. 1981 118 p

(Contract W-7405-eng-26)

(ORNL/TM-7635) Avail: NTIS HC A06/MF A01

Increased utilization of coal and other fossil fuel alternatives as sources of clean energy is reported. The following topics are discussed: coal conversion development, chemical research and development, materials technology, component development and process evaluation studies, technical support to major liquefaction projects, process analysis and engineering evaluations, fossil energy environmental analysis, flue gas desulfurization, solid waste disposal, coal preparation waste utilization, plant control development, atmospheric fluidized bed coal combustor for cogeneration, TVA FBC demonstration plant program technical support, PFBC systems analysis, fossil fuel applications assessments, performance assurance system support for fossil energy projects, international energy technology assessment, and general equilibrium models of liquid and gaseous fuel supplies. DOE

N81-28531# Sandia Labs., Albuquerque, N. Mex.

OPERATING EXPERIENCE AT THE CENTRAL RECEIVER TEST FACILITY (CRTF)

John T. Holmes, W. Ken Bell, David L. King, Larryl K. Matthews, and Larry O. Seamons 1981 10 p refs Presented at the Ann. Conf. of the Intern. Solar Energy Soc., Philadelphia, 26 May 1981

(Contract DE-AC04-76DP-00789)

(SAND-80-2504C; CONF-810509-13) Avail: NTIS HC A02/MF A01

The CRTF, constructed to develop solar central receiver components, began operating in October, 1978. To date, three solar receivers that used either air, water/steam, or a molten nitrate salt as their working fluid were successfully characterized. Also, seven heliostat concepts were evaluated. These included two competing designs for the 10 MWe solar pilot plant now under construction near Barstow, California, a privately sponsored design, and four advanced designs. Almost three years of operation of the CRTF provided data and experience on the performance and maintenance requirements for typical components of a solar central receiver system. DOE

N81-28532# Sandia Labs., Albuquerque, N. Mex.

GEOTHERMAL DRILLING AND COMPLETION TECHNOLOGY DEVELOPMENT PROGRAM PLAN

Samuel G. Varnado, James R. Kelsey, and Donald L. Wesenberg Feb. 1981 94 p refs

(Contract DE-AC04-76DP-00789)

(SAND-81-0380) Avail: NTIS HC A05/MF A01

A long-range plan for the development of new technology that will reduce the cost of drilling and completing geothermal wells is presented. The goals of this program are to develop the technology required to reduce the cost of drilling and completing geothermal wells by 25% in the near term and by 50% in the long term. Efforts under this program to date have resulted in new roller bit designs that will reduce well costs by 2% to 4%, new drag bits that have demonstrated marked increases in penetration rate, and the field verification of the effectiveness of inert drilling fluids in reducing drill pipe corrosion. DOE

N81-28533# Department of Energy, Washington, D. C. Energy Information Administration.

ENERGY DATA REPORT: SOLAR COLLECTOR MANUFACTURING ACTIVITY, JULY - DECEMBER 1980

Mar. 1981 50 p

(DOE/EIA-0174/80-2) Avail: NTIS HC A03/MF A01

Statistics on solar collector manufacturing activity for both solar thermal collectors and photovoltaic modules through 1980 are presented. Summary data are given for the number of manufacturers and collector area produced each year from 1974 through 1980; data for collector type are included, i.e., low temperature or medium temperature and special collectors. Producer shipments are tabulated according to location of company headquarters, producer size, and collector types. Impport and export activity is tabulated; and tables are given showing the application according of end use, market sector, and market sectors and company headquarers location. The number of companies engaged in activities related to solar collector manufacturing for 1978 through 1980 are listed; and the number of manufacturers and market sector are tabulated for photovoltaic modules manufacturing activities. DOE

N81-28534# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT INFORMATION USER STUDY

W. W. Belew, B. L. Wood, T. L. Marle, and C. L. Reinhardt Mar. 1981 246 p

(Contract EG-77-C-01-4042)

(SERI/TR-751-751) Avail: NTIS HC A11/MF A01

Information on solar industrial and agricultural process heat (IAPH) are described. The results of a study on many different solar technologies, identify types of information each group needed and the best ways to get information to each group. Results from 10 IAPH groups of respondents are analyzed in this report: IPH Researchers; APH Researchers; Representatives of Manufacturers of Concentrating and Nonconcentrating Collectors; Plant, Industrial, and Agricultural Engineers, Educators, Representatives of State Agricultural Offices, and County Extension Agents. DOE

N81-28535# New Zealand Energy Research and Development Committee, Auckland.

FEASIBILITY OF A GEOTHERMAL DISTRICT HEATING SCHEME

J. J. Lorentz and M. V. Mountfort 1980 47 p refs

(NZERDC-55) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The present development and exploitation of geothermal energy use in Rotorua and Taupo are reviewed with reference to the future development of a Geothermal District Heating (GDH) scheme. Other aspects which affect the future viability of a GDH scheme include: heat load densities for the Rotorua City area and the Taupo Borough area, energy usage patterns in Rotorua and Taupo, and household energy consumption in Rotorua and Taupo. In addition, the results of three market surveys are summarized: of nongeothermal users in residential areas of Rotorua and Taupo, of geothermal users in residential areas of Rotorua, and of non geothermal users in industrial and commercial areas of Rotorua and Taupo. The conclusions drawn from the market surveys were used to formulate recommendations for the futue investigations, and to prepare the terms of reference for a further study project. DOE

N81-28536# Sandia Labs., Albuquerque, N. Mex. Exploratory Systems Div.

DESIGN, COST, AND PERFORMANCE COMPARISONS OF

SEVERAL SOLAR THERMAL SYSTEMS FOR PROCESS HEAT. VOLUME 3: RECEIVERS
J. B. Woodard, Jr. Mar. 1981 114 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8281-Vol-3) Copyright. Avail: NTIS HC A06/MF A01

The receiver subsystem converts reflected solar radiation into thermal power by heating a working fluid. The cost and performance were estimated for the receiver subsystem for parabolic troughs, parabolic dishes, and central receivers over a wide range of temperatures and power levels for thermal power applications. The fundamental design philosophy employed, the constraints identified, the tradeoffs performed and the cost and performance results obtained for each receiver in the study matrix are described. DOE

N81-28537# Sandia Labs., Albuquerque, N. Mex. Energy System Studies Div.
DESIGN, COST AND PERFORMANCE COMPARISONS OF SEVERAL SOLAR THERMAL SYSTEMS FOR PROCESS HEAT. VOLUME 4: ENERGY CENTRALIZATION
J. J. Iannucci and L. D. Hostetler Mar. 1981 94 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8282-Vol-4) Avail: NTIS HC A05/MF A01

A large matrix of self-consistent piping systems for dishes, troughs, and central receivers are designed, costed, and analyzed for performance. The solar installations collect thermal energy at temperatures ranging from 2000 to 20000 F, at sizes of 3, 30, 300, and 1500 megawatts thermal. First order design differences and similaies are highlighted, with emphasis on the comparison of dish and trough piping. Dishes are found to inefficient piping networks due to the large length of piping required. DOE

N81-28538# Houston Univ., Tex. Energy Lab.
USER MANUAL FOR THE UNIVERSITY OF HOUSTON SOLAR CENTRAL RECEIVER, CELLWISE PERFORMANCE MODEL: NS, VOLUME 1
F. W. Lipps and L. L. Vant-Hull Dec. 1980 198 p refs 2 Vol.
(Contract DE-AC03-79SF-10763)
(DOE/SF-10763/T9-Vol-1; SAN-0763-4-Vol-1) Avail: NTIS HC A09/MF A01

The central receiver cellwise performance model which simulates the optical performance of a solar central receiver system is described. The system contains a collector field with a large number of identical, individually guided, heliostats which reflect sunlight to a tower top receiver. For simulation, the collector field is divided into cells, and a representative heliostat at each cell center is used to estimate the effect of the heliostats in the cell. Typical applications include: a receiver flux density run, an annual performance summary run, a start-up performance study, and a performance study during a cloud passage. DOE

N81-28539# Houston Univ., Tex. Energy Lab.
USER MANUAL FOR THE UNIVERSITY OF HOUSTON SOLAR CENTRAL RECEIVER, CELLWISE PERFORMANCE MODEL: NS, VOLUME 2
F. W. Lipps and L. L. Vant-Hull Dec. 1980 123 p 2 Vol.
(Contract DE-AC03-79SF-10763)
(DOE/SF-10763/T9-Vol-2; SAN-0763-4-Vol-2) Avail: NTIS HC A06/MF A01

A complete listing is given of the inputs and outputs of four test runs designed to illustrate the most important features of the NS cellwise performance code. DOE

N81-28540# Hirai (W. A.) and Associates, Inc., Hilo, Hawaii.
HYDROELECTRIC POWER IN HAWAII. A RECONNAISSANCE SURVEY
Feb. 1981 205 p refs Sponsored in part by Hawaii State Dept. of Planning and Economic Development
(Contract DE-FC49-80R-910031)
(DOE/R9-10031/T2) Avail: NTIS HC A10/MF A01

Hydropower resources in the State of Hawaii are assessed. Hydropower resources on all islands total about 50 megawatts of potential generating capacity. Combined with the 18 megawatts of existing hydropower capacity, hydropower resources potentially could generate about 307 million kilowatt-hours of electric energy annually. This represents about 28 percent of the present combined electricity needs of the Neighbor Islands - Kauai, Molokai, Maui, and the Big Island. The island of Oahu, however, has only small hydropower resources, and could only generate a negligible portion of its electricity needs from this energy source. Existing and potential hydropower capacities are summarized, and annual outputs for each island are estimated. DOE

N81-28541# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
LIGHTWEIGHT CONCRETE OTEC COLD WATER PIPE TESTS, PHASE 2
J. S. OConnor, ed. Mar. 1981 313 p refs
(Contract DE-AI01-77ET-20342)
(JHU/APL-SR-80-5A) Avail: NTIS HC A14/MF A01

A one third scale model of a cold water pipe (CWP) for a 40 MW/sub ocean thermal energy conversion (OTEC) plantship was constructed of reinforced lightweight concrete and tested to destruction. Failure occurred at approximately 138 percent of the design load for the once in 100 year storm condition in the Atlantic-1 siting area. The concept of using Neoprene bearing pads to provide flexibility of the joint between pipe segments was also verified. Measured deflections and stresses generally agreed with computer generated predictions and validated the design methods used. It is indicated that a light weight concrete CWP can be built with conventional material, and processes. DOE

N81-28542# Duke Univ., Durham, N. C.
ASSESSMENT OF ACTIVE SOLAR SYSTEMS IN THE RESIDENTIAL SECTOR OF NORTH CAROLINA, 1974 - 1995 Report, 1 Nov. 1978 - 31 Dec. 1979
Diane Brown and Karen St.John 1 Feb. 1981 55 p refs Sponsored by Dept. of Commerce
(NCEI-0030) Avail: NTIS HC A04/MF A01

An evaluation is presented of the contribution active solar systems can make in North Carolina's residential sector over the next 15 years. The report is divided into 5 parts: introduction; current solar industry status; projected use of active solar systems to 1995; maximum potential for active solar systems to 1995; recommendations for state solar incentives. Information in the appendices includes: conversion methodology; square feet of collector to Btu; economic analysis of solar systems based on life costs; methodology for percentage breakdowns on projected solar system sales; North Carolina solar manufacturers/distributors and national manufacturers; solar legislation; economic analysis of solar systems; and data sources. DOE

N81-28543# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
THIN FILM BATTERY/FUEL CELL POWER GENERATING SYSTEM Final Report, 1 Apr. 1978 - 31 Mar. 1980
W. Feduska, A. O. Isenberg, J. E. Bauerle, E. F. Federmann, Y. Ichikawa, R. J. Ruka, E. J. Vidt, S. A. Zeitman, and G. E. Zymboly 30 Jun. 1980 216 p refs
(Contract DE-AC03-79ET-11305)
(DOE/ET-11305/T7; C-1197-17) Avail: NTIS HC A10/MF A01

Research on the design, development, and testing of a high temperature solid electrolyte (HTSOE) fuel cell is described. Development and refinement of fabrication processes for the porous support tube, fuel electrode, solid electrolyte, air electrode, and interconnection are included. Life testing was conducted of cell components and the stack. Stack performance was evaluated. DOE

N81-28544# Galaxy, Inc., Washington, D.C.
JAPANESE RESEARCH AND DEVELOPMENT OF FUEL CELLS
Feb. 1981 28 p
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T6) Avail: NTIS HC A03/MF A01

An overview of the Japanese fuel cell program is presented including an historical background of Japanese research and development of fuel cells, the research and development in the Moonlight Project, and a description of the current status of activities of private companies which expect to purchase fuel cells. DOE

N81-28545# Alabama Univ. in Huntsville. Dept. of Mechanical Engineering.

NUMERICAL AND EXPERIMENTAL STUDIES OF LIQUID STORAGE TANK THERMAL STRATIFICATION FOR A SOLAR ENERGY SYSTEM

S. T. Wu Nov. 1980 81 p refs

(Contracts DE-AS02-77CS-34479; EG-77-S-02-4479)

(DOE/CS-34479/3) Avail: NTIS HC A05/MF A01

The results of theoretical and experimental studies of thermal stratification in liquid energy storage tanks for the performance of solar energy systems are presented. The investigation was divided into three areas: (1) justification of the importance of thermal stratification inside the energy storage tanks; (2) development of simple mathematical model which is compatible with existing solar energy system simulation code; and (3) validation of mathematical models by experimental data obtained from realistic solar energy system operations. DOE

N81-28546# Sandia Labs., Livermore, Calif. Energy Systems Studies Div.

IMPACT OF NATURAL CLEANING ON THE SELECTION OF A WASHING SYSTEM FOR SOLAR COLLECTORS

Alan Kerstein Apr. 1981 25 p refs

(Contract DE-AC04-76DP-00189)

(SAND-81-8636) Avail: NTIS HC A02/MF A01

The desired optical properties (reflectivity, transmissivity, etc.) of solar energy collector surfaces such as mirrors and photovoltaic surfaces are degraded over time by soiling. Cost benefit evaluation of alternative methods for washing the surface or retarding the optical degradation must take into account natural cleaning processes such as precipitation and frost, which impact the scheduling as well as the benefits of washing. A probabilistic method developed to address this question is used to compare truck-mounted versus mirror-mounted washing systems for central receiver plants. The comparison of these systems is shown to be sensitive to the seasonally-varying frequency and effectiveness of natural cleaning processes. The implications of this analysis for such diverse issues as cost/benefit evaluation of soil-retardant mirror coatings and formulation of plant site selection criteria are noted. DOE

N81-28547# Sandia Labs., Livermore, Calif.

DESIGN, COST, AND PERFORMANCE COMPARISONS OF SEVERAL SOLAR-THERMAL SYSTEMS FOR PROCESS HEAT. VOLUME 2: CONCENTRATORS

E. D. Eason Mar. 1981 68 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-8280-Vol-2) Avail: NTIS HC A04/MF A01

The major mechanical design and cost differences between concentrator subsystems are identified. Parabolic dishes and troughs are designed to the same specifications as heliostats, using the same glass mirror/steel structure design concept and their costs are estimated on a consistent, comparable basis, using the heliostat cost data base. Inherent cost differences arise from differences in geometry, the cost of providing curvature and wind loadings. The estimated cost increases, relative to heliostats, are 15 percent to 50 percent for dishes and 0 percent to 30 percent for troughs, considering the combined effect of several analysis uncertainties. DOE

N81-28548# Arizona State Univ., Tempe. Dept. of Mechanical and Energy Systems Engineering.

SIMPLIFIED DESIGN GUIDE FOR ESTIMATING PHOTOVOLTAIC FLAT ARRAY AND SYSTEM PERFORMANCE

D. L. Evans, W. A. Facinelli, and L. P. Koehler Mar. 1981 169 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-7189) Avail: NTIS HC A08/MF A01

Simplified, non-computer based methods are presented for predicting photovoltaic array and system performance. The array performance prediction methods are useful for calculating the potential output of passively cooled, flat, south facing max-power tracked arrays. A solar/weather data base for 97 different US and US affiliated stations is provided to aid in these calculations. Performance estimates can be made for photovoltaic systems (array, battery, power conditioner) that are backed-up by non-solar reserves capable of meeting the load when the solar system cannot. Such estimates can be made for a total of 41 different sinusoidal, unimodal, and bimodal diurnal load profiles from appropriate graphs included. DOE

N81-28549# Arizona State Univ., Tempe. Dept. of Mechanical and Energy Systems Engineering.

SIMPLIFIED DESIGN GUIDE FOR ESTIMATING PHOTOVOLTAIC FLAT ARRAY AND SYSTEM PERFORMANCE

D. L. Evans, W. A. Facinelli, and L. P. Koehler Mar. 1981 112 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.

(Contract DE-AC04-76DP-00789)

(SAND-80-7185) Avail: NTIS HC A06/MF A01

Simplified, non-computer based methods are presented for predicting photovoltaic array and system performance. The array performance prediction methods are useful for calculating the potential output of passively cooled, flat, south facing max power tracked arrays. A solar/weather data base for 97 different US and US affiliated stations is provided to aid in these calculations. Performance estimates can be made for photovolatic systems (array, battery, power conditioner) that are backed up by non-solar reserves capable of meeting the load when the solar system cannot. Such estimates can be made for a total of 41 different sinusoidal, unimodal, and bimodal diurnal load profiles from appropriate graphs included. DOE

N81-28550# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

BIOTECHNOLOGY FOR PRODUCING FUELS AND CHEMICALS FROM BIOMASS. VOLUME 2: FERMENTATION CHEMICALS FROM BIOMASS

R. Villet, ed. Feb. 1981 58 p refs

(Contract DE-AC02-77CH-00178)

(SERI/TR-621-754-Vol-2) Avail: NTIS HC A04/MF A01

The technological and economic feasibility of producing chemicals by fermentation is discussed: acetone; butanol; acetic acid; citric acid; 2,3-butanediol, and propionic acid. Improved cost of fermentative production will hinge on improving yields and using cellulosic feedstocks. The market for acetic acid is likely to grow 5 percent to 7 percent/yr. A potential process for production is the fermentation of hydrolyzed cellulosic material to ethanol followed by chemical conversion to acetic acid. The feedstock cost is 15 to 20 percent of the overall cost of production. The anticipated 5 percent growth in demand for citric acid could be enhanced by using it to displace phosphates in detergent manufacture. A number of useful chemicals can be derived from 2,3-butanediol, which has not been produced commercially on a large scale. The commercial fermentative production of propionic acid has not yet been developed. DOE

N81-28551# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

DESIGN CONSIDERATIONS FOR SOLAR INDUSTRIAL PROCESS HEAT SYSTEMS: NONTRACKING AND LINE FOCUS COLLECTOR TECHNOLOGIES

Charles F. Kutscher, ed. Mar. 1981 64 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-632-783) Avail: NTIS HC A04/MF A01

Items are listed that should be considered in each aspect of the design of a solar industrial process heat system. The collector technologies covered are flat plate, evacuated tube, and line focus. Qualitative design considerations are stressed rather than specific design recommendations. DOE

N81-28552# Brookhaven National Lab., Upton, N. Y.

STUDY OF GAP STATES IN A-Si:H ALLOYS BY MEASUREMENTS OF PHOTOCONDUCTIVITY AND SPECTRAL RESPONSE OF MIS SOLAR CELLS

P. E. Vanier, A. E. Delahoy, and R. W. Griffith 1981 7 p refs Presented at the Conf. on Tetrahedrally Bonded Amorphous Semi-Conductors, Carefree, Ariz., 12 Mar. 1981

(Contract DE-AC02-76CH-00016)

(BNL-29160; CONF-810331-1) Avail: NTIS HC A02/MF A01

Modifications in n(E) were studied by the effects of selected impurities on the conversion efficiency and spectral response of MIS and p-i-n solar cells. A picture of the density of gap states n(E) in glow discharge a-Si:H is constructed using four different kinds of transport measurement on a large number of samples. The minimum in n(E) lies 0.4 eV below E sub c, rather

than in the middle of the gap. A distribution of fast recombination centers lies at mid gap, and two sets of hole traps lie between mid gap and the valence band.

N81-28553# Mueller Associates, Inc., Baltimore, Md.
ECONOMIC ANALYSIS OF COMMERCIAL SOLAR COMBINED SPACE-HEATING AND HOT-WATER SYSTEMS
23 Sep. 1980 66 p Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL-K-80-53; MAI-204) Avail: NTIS HC A04/MF A01

Typical commercial solar energy systems and typical cost and performance levels are outlined. The economic performance of solar energy systems are described through the use of cash flow diagrams. The diagrams indicate the cumulative cash situation of a solar investment over the life of the investment. The economic performance of solar energy systems is outlined through the calculation of equivalent return on investment (ROI). Appendices are included to enable calculating the ROI for any particular solar energy system investment. DOE

N81-28554# Mueller Associates, Inc., Baltimore, Md.
ECONOMIC ANALYSIS OF NON-TAXED COMMERCIAL SOLAR HOT WATER SYSTEMS AND COMBINED HEATING AND HOT WATER SYSTEMS
23 Sep. 1980 85 p
(Contract MAI-205)
(ANL-K-80-44) Avail: NTIS HC A05/MF A01

An economic analysis of nontaxed commercial solar systems is presented. A realistic evaluation of current cost effectiveness of nontaxed commercial solar energy systems is provided. Economic considerations involved in the decisions to invest in a solar system are described. Easy to use tools to make rational decisions regarding economic viability of nontaxed commercial solar energy systems in a particular application are outlined. E.A.K.

N81-28555# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BASELINE DESIGNS OF MOORED AND GRAZING 40-MW OTEC PILOT PLANTS. VOLUME A: DETAILED REPORT
J. F. George and D. Richards Jun. 1980 270 p refs Prepared jointly with ABAM Engineers, Tacoma and Glosten (L. R.) and Associates, Inc., Seattle 2 Vol.
(Contracts DE-AI01-77ET-20343; N00024-78-C-5384)
(JHU/APL-SR-80-1-Vol-A) Avail: NTIS HC A12/MF A01

Baseline designs of two types of floating Ocean Thermal Energy Conversion (OTEC) pilot plants are presented. Both designs feature floating concrete hull structures that house up to 40 MW sub e (net) of OTEC power systems. One plant is designed for moored operation at an island site, and use underwater cables to transmit electric power to a shore-based utility company. The other plant is self-propelled and cruises slowly through tropical waters, using the OTEC electric power to produce an energy intensive product onboard, where it is stored for later transshipment to market. DOE

N81-28556# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BASELINE DESIGNS OF MOORED AND GRAZING 40-MW OTEC PILOT PLANTS. VOLUME B: ENGINEERING DRAWINGS
Jun. 1980 270 p Prepared jointly with ABAM Engineers, Tacoma and Glosten (L. R.) and Associates, Inc., Seattle 2 Vol.
(Contracts DE-AI01-77ET-20342; N00024-78-C-5384)
(JHU/APL-SR-80-Vol-B) Avail: NTIS HC A12/MF A01

Baseline design data are presented for two types of floating Ocean Thermal Energy Conversion (OTEC) pilot plants: (1) a moored plant that uses underwater cables to transmit electric power to a shore-based utility company, and (2) a cruising plantship that uses the OTEC electric power to produce an energy-intensive product onboard, where it is stored for later transshipment to market. Engineering drawings of the hull, cold-water pipe, ship outfitting and machinery, OTEC power system, electrical system, and folded-tube heat exchangers are provided. DOE

N81-28557# Oak Ridge National Lab., Tenn. Energy Div.
POTENTIAL FOR DISTRICT HEATING: AN HISTORICAL OVERVIEW
Martin A. Broders Mar. 1981 25 p Presented at the District Heating Tech. Training Workshop, Washington, D.C., 1-3 Apr. 1981
(Contract W-7405-eng-26)
(CONF-810435-1) Avail: NTIS HC A02/MF A01

An introduction to district heating is outlined. Attention is focused on the potential of district heating to meet the nation's energy conservation, environmental and social objectives. Basic terms are defined and the principal of district heating operation is described. District heating thermal energy sources, transport and distribution piping, and consumer secondary heating systems are discussed in general terms. A brief historical overview is presented. The history and status of district heating in Europe are also summarized. The advantages of district heating are outlined, and the primary factors that impeded the implementation of district heating in the US are discussed. DOE

N81-28558# Oak Ridge National Lab., Tenn. Energy Div.
ENERGY ISSUES RELEVANT TO DOMED CITIES. WINOOSKI, VERMONT: A CASE STUDY
Robert E. Gant 1980 15 p refs Presented at 1st Intern. Dome Symp., Winooski, Vt., 27 Mar. 1980
(Contract W-7405-eng-26)
(CONF-8003107-2) Avail: NTIS HC A02/MF A01

Enclosing all or a significant portion of a small urban community within a large secondary building envelope (dome) was examined as a potential alternative energy strategy. The concept of secondary envelopes as a community level energy strategy is discussed. Five alternative energy strategies are presented which might be less costly and technically complex than an urban envelope. The alternatives focused upon local options and resources to affect reductions in total energy consumption and scarce fuels. Insulation and use of efficient appliances, hydroelectric development, installation of cogeneration/district heating systems, use of solar technologies, and combinations of technologies are discussed. The alternatives represent examples of the opportunities available to local governments to exercise a degree of control over the community's energy future. DOE

N81-28559# Georgetown Univ., Washington, D.C.
GEORGETOWN UNIVERSITY INTEGRATED COMMUNITY ENERGY SYSTEM (GU-ICES). PHASE 3, STAGE 1: FEASIBILITY ANALYSIS, VOLUME 1 Final Report
Oct. 1980 331 p refs
(Contracts DE-AC02-77CS-20068; EC-77-C-02-4488)
(DOE/CS-20068/4-Vol-1) Avail: NTIS HC A15/MF A01

This Feasibility Analysis covers a wide range of studies and evaluations: (1) consideration of the requirements and position of the Potomac Electric Co. as they relate to cogeneration at Georgetown in parallel with the utility; (2) technical information relating to the Alternative Subsystems Analysis; (3) energy demand profiles upon which the evaluations were based; (4) results of the Life-Cycle-Cost Analysis. Also included is the material relating to Incremental Savings and Optimization and the Conceptual Design for candidate alternate subsystems. The Appendix contains supplementary material including the budget cost estimates used in the life-cycle-cost analyses, the basic assumptions upon which the life-cycle analyses were developed, and the detailed life-cycle-cost analysis for each subsystem considered in detail. DOE

N81-28560# Argonne National Lab., Ill.
DOE'S NEAR-TERM ELECTRIC VEHICLE BATTERY PROGRAM. STATUS OF IMPROVED LEAD-ACID, NICKEL/IRON, AND NICKEL/ZINC BATTERY DEVELOPMENTS
N. P. Yao, C. C. Christianson, R. C. Elliot, T. S. Lee, and J. F. Miller 1980 48 p refs Presented at the 3d Intern. Elec. Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract W-31-109-eng-38)
(CONF-800523-4) Avail: NTIS HC A03/MF A01

Significant progress in lead acid, nickel/iron and nickel/zinc battery technology was made towards achieving the technical performance goals necessary for widespread use of these battery systems in electric vehicle applications. The energy density of lead acid eV batteries has advanced from 25 to 30 Wh/kg to

over 40 Wh/kg. The prospect for obtaining a lead acid battery having both high energy density and long cycle life in a few years is very promising. Nickel/iron modules demonstrated a specific energy of nearly 50 Wh/kg and a specific power of 100 W/kg, cycle lives of 300 were achieved during early 1980 and testing continues, and the energy efficiency was improved from less than 50 percent to over 65 percent. Nickel/zinc module test data show a specific energy of nearly 70 Wh/kg and a specific power of 130 W/kg. However, cycle life improvements are still needed. Cost reduction continues to receive major emphasis at developers of both nickel/zinc and nickel/iron batteries. DOE

N81-28561# Midwest Research Inst., Golden, Colo. Solar Thermal Program Branch.

SOLAR THERMAL COST GOALS

R. B. Edelstein Jan. 1981 9 p refs Presented at the 3rd Ann. Systems Simulation, Economic Analysis/Solar Heating and Cooling Operational Results Conf., Reno, Nev., 29 Apr. - May 1981

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-633-1063; CONF-810405-13) Avail: NTIS HC A02/MF A01

Setting of goals for a research, development and demonstration program is critical in measuring its progress and ensuring its success. The development of cost goals for the DOE Solar Thermal Program by the Solar Thermal Cost Goals Committee (STCGC), led by the Solar Energy Research Institute, is described. The objective of the STCGC is to determine a consistent set of time-related cost and performance goals for concentrating collector systems based on market value and intermediate goals based on attainable cost levels. Accomplishments thus far include: definition of cost goals and their function in program planning, delineation of competing energy system costs, development of a breakeven costing methodology for assessing market value, determination of attainable costs for solar thermal systems, setting financial and economic parameters, and calculation of market value as a function of each competing fuel type, application, and region. DOE

N81-28562# Midwest Research Inst., Golden, Colo.

PREFERENCES AND CONCERNS OF POTENTIAL USERS IN THE SELECTION OF SOLAR THERMAL SYSTEMS FOR INDUSTRIAL AND SMALL UTILITY APPLICATIONS

James B. Gresham (Science Applications, Inc., Golden Colo.) and Thomas A. Kriz Mar. 1981 12 p refs Presented at the 8th Energy Technol. Conf. and Exposition, Washington, D.C., 9-11 Mar. 1981

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TP-731-1128; CONF-810315-9) Avail: NTIS HC A02/MF A01

To achieve widespread application in the industrial and utility sectors, solar systems must be economically competitive. Economic viability is, in turn, determined by a number of supporting criteria, ranging from system reliability to dispatch characteristics to how the system supports the main product line. In addition, solar systems possess some inherent attributes that may render some of the traditional supporting criteria inappropriate or require their redefinition. Those criteria and their relation to the solar investments are discussed in three steps. First, the main concerns and preferences of the potential users, as identified in recent SERI studies, are identified. Second, the equitability of the resulting decision criteria for solar investments are examined. Finally, the implications of these criteria for solar energy's penetration into these markets are discussed. DOE

N81-28563# Lincoln Lab., Mass. Inst. of Tech., Lexington.

HEAT PUMPS AND UTILITY-INTERACTIVE PHOTOVOLTAIC POWER SYSTEMS

Duncan B. Sheldon 1981 5 p refs Presented at the Ann. Conf. of the Intern. Solar Energy Soc., Philadelphia, 27-30 May 1981

(Contract DE-AC02-76ET-20279)

(DOE/ET-20279/120; CONF-810509-8) Avail: NTIS HC A02/MF A01

The performance of a residential air source heat pump driven by a utility interactive photovoltaic power system is described. The heating capacity and coefficient of performance of the heat pump were determined at different outdoor coil supply air temperatures. This was done when the heat pump was powered exclusively by the utility and displaced by photovoltaic power. It was found that the heat pump's steady state performance when driven by the utility interactive photovoltaic power system is nearly indistinguishable from its conventional steady state operation. DOE

N81-28564# Lincoln Lab., Mass. Inst. of Tech., Lexington.

THREE-YEAR PERFORMANCE STUDY OF THE MEAD, NEBRASKA, 25-kWp PHOTOVOLTAIC POWER SYSTEM

Henry J. Bullwinkel and Raymond F. Hopkinson 1981 6 p refs Presented at the Ann. Conf. of the Intern. Solar Energy Soc., Philidelphia, 27-30 May 1981

(Contract DE-AC02-76ET-20279)

(DOE/ET-20279/122) Avail: NTIS HC A02/MF A01

The performance of a 25 kWp photovoltaic (PV) solar energy system was studied. Electrical energy produced by the PV system provided 100% of the power needed throughout the growing season to meet the irrigation requirements for an 80 acre cornfield, as well as significant portions of power required for PV related crop drying and fertilizer manufacturing experiments. Field data indicate that the PV system performs up to expectations, if allowance is made for component degradation and seasonal soil/snow accumulation on the array. DOE

N81-28565# Lincoln Lab., Mass. Inst. of Tech., Lexington.

RELIABILITY OF TERRESTRIAL PHOTOVOLTAIC MODULES AT VARIOUS DOE/MIT LINCOLN LABORATORY TEST SITES

S. E. Forman and M. P. Themelis 30 Mar. 1981 5 p refs Presented at the 15th IEEE PV Specialist Conf., Orlando, Fla., 11-15 May 1981

(Contract DE-AC02-76ET-20279)

(DOE/ET-20279/126; CONF-810526-1) Avail: NTIS HC A02/MF A01

During the past four years, acting under the auspices of the US Department of Energy, Massachusetts Insitute of Technology Lincoln Laboratory built and operated in the United States photovoltaic power-generating systems ranging in size from less than 1 kWp to 100 kWp. Slightly more than 11,000 modules from several maufacturers were utilized at these sites with a cumulative number of electricl failures of approximately 2%. Discussion is presented of module performance at two of these sites: a 25-kWp array field at Mead, Nebraska, and a 100-kWp array field at Natural Bridges National Monument, Utah. Data and photographs of module failures, failure modes, physical and electrical degradation, and array diagnostics are presented for each of the five different types of modules utilized at these sites. DOE

N81-28566# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SOLAR PHOTOVOLTAIC RESIDENCE IN CARLISLE, MASSACHUSETTS

S. J. Strong (Solar Design Associated, Lincoln, Mass.) and B. E. Nichols 1981 4 p Presented at the Ann. Conf. of the Intern. Solar Energy Soc., Philadelphia, 27-30 May 1981

(Contract DE-AC02-76ET-20279)

(DOE/ET-20279/129; CONF-810509-9) Avail: NTIS HC A02/MF A01

The first solar photovoltaic house designed and constructed under the US Department of Energy's Solar Photovoltaic Residential Project is studied. The house, which is powered by a 7-k Wp photovoltaic (PV) system, will be used to assess the occupants' acceptance of and reactions to residential photovoltaic systems and to familiarize utilities, builders, developers, town building officials and others with issues concerning photovoltaic installations. The house includes energy conservation and passive solar features. It utilizes a roof mounted, flat plate PV array which operates in a two way energy exchange mode with the electric utility. The energy conservation and passive solar features of this house are described and a detailed description of the utility interactive photovoltaic system is presented, along with initial performance data. DOE

N81-28567# Midwest Research Inst., Golden, Colo.

APPLIED RESEARCH IN THE SOLAR THERMAL ENERGY SYSTEMS PROGRAM

C. T. Brown (Georgia Inst. of Technology, Atlanta) and J. M. Lefferdo Mar. 1981 7 p refs Presented at the Ann. Conf. of the Intern. Solar Energy Soc., Philadelphia, 26-30 May 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-633-1148; CONF-810509-10) Avail: NTIS HC A02/MF A01

Within the Solar Thermal Research and Advanced Development (RAD) program a coordinated effort in materials research, fuels and chemical research and applied research is being carried out to meet the systems needs. Each of these three program elements is described with particular attention given to the applied research activity. DOE

N81-28568# Mueller Associates, Inc., Baltimore, Md.
ECONOMIC ANALYSIS OF RESIDENTIAL SOLAR WATER HEATERS
John Carlock and Ronald Overton 23 Sep. 1980 98 p refs
(Contract W-31-109-eng-38)
(ANL-K-80-68; MAI-201) Avail: NTIS HC A05/MF A01

A residential solar water heater, cost and performance information, and monthly costs and savings of the typical system are discussed. Economic evaluations of solar water heaters are presented in increasingly complex levels of detail. Utilizing a typical system, the effective interest rate that the purchaser of a system would receive on money invested is shown for all regions of the country. The importance of numerous variables that can make a significant difference on the economics of the system is described. Methods for calculating the payback period for any nontypical solar water heater are described. This calculated payback period is shown to be related to the effective interest rate that the purchaser of the system would receive for a typical set of economic conditions. A method is presented to calculate the effective interest rate that the solar system can provide. DOE

N81-28569# Arizona State Univ., Tempe. Coll. of Architecture.
HARDWARE PACKAGE AND WORKSHOP DEVELOPMENT FOR HOMEOWNER SOLAR WATER HEATER Final Report
Stanley A. Mumma Sep. 1980 288 p refs
(Contract DE-FG03-78SF-01973; Grant EM-78-G-03-1973)
(DOE/SF-01973/T1) Avail: NTIS HC A13/MF A01

It was the purpose of this project to: (1) develop a standard solar hot water heater package, (2) develop a workshop for the assembly of these components by the homeowner, (3) provide guidance on how the components may be retrofit to existing homes in accordance with local codes and good practices, (4) provide operating and maintenance instructions, and (5) provide this community service at a target cost of $300 to $400 for the complete solar water package including the enrollment and workshop. The solar hot water system's thermal performance and development of a solar company are discussed. Nationwide expansion of the program is proposed. DOE

N81-28570# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
USE OF AN OPEN-CYCLE ABSORPTION SYSTEM FOR HEATING AND COOLING
D. R. Schlepp and R. K. Collier Mar. 1981 7 p refs Presented at the Intern. Solar Energy Soc. Am. Sect. Ann. Conf., Philadelphia, 26-30 May 1981
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TP-631-1159; CONF-810509-11) Avail: NTIS HC A02/MF A01

Solar cooling for commercial applications using open cycle absorption refrigeration systems was investigated. If an open cycle absorption can be operated as a chemical heat pump for winter heating operation, the system offers year round operation that makes the system economically viable for many regions of the US. An analysis of heating operation for the open cycle system using a computer program that simulates heat and mass transfer processes for any environmental condition is also presented. The open cycle absorption refrigeration system can be operated as a chemical heat pump. Simulations for winter heating operation were run for five US cities, with solar SOP's in the range of 0.6 to .16. It is concluded that at these levels, the OCAR system can provide full heating and cooling operation for office buildings in many southern US cities. DOE

N81-28571# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
VALUE OF THERMAL STORAGE IN SOLAR IPH SYSTEMS
S. M. Hock and M. E. Karpuk Dec. 1980 7 p refs Presented at the 3rd Ann. Systems Simulation, Econ. Analysis/Solar Heating and Cooling Operational Results Conf., Reno, Nov., 27 Apr. 1981
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TR-731-905; CONF-810405-14) Avail: NTIS HC A02/MF A01

The value of thermal storage for three solar industrial process heat systems for capacities of 3 to 4000 hours was determined. The dominant source of storage value is backup fuel savings with additional value derived from increased capital equipment utilization and elimination. A computer simulation was used to model the operation of the solar IPH system and predict the amount of fuel saved by heat delivered from storage. Sensitivity of storage value of process temperature, collector cost, load profile, insolation, and storage efficiency was calculated. Storage values ranged from heat zero t as high as S42/kWH of storage capacity. DOE

N81-28572# Argonne National Lab., Ill.
COMPARATIVE HEALTH AND SAFETY ASSESSMENT OF ALTERNATIVE FUTURE ELECTRICAL GENERATION SYSTEMS
L. J. Habegger, J. R. Casper, and C. D. Brown 1980 7 p refs Presented at the Intern. Symp. on Alternative Energy Sources and Technol., Montreal, 28-30 May 1980
(Contract W-31-109-eng-38)
(CONF-800567-6) Avail: NTIS HC A02/MF A01

An analysis is made of health and safety risks of seven alternative electrical generation systems, all of which have potential for commercial availability in the post 2000 timeframe. The systems are compared on the basis of expected public and occupational deaths and lost workdays per year associated with 1000 MWe average unit generation. Risks and their uncertainties are estimated for all phases of the energy production cycle; including fuel and raw material extraction and processing, direct and indirect component manufacture, on site construction, and system operation and maintenance. DOE

N81-28573# Purdue Univ., Lafayette, Ind. Lab. of Renewable Resources Engineering.
FUNDAMENTAL STUDY OF THE MECHANISM AND KINETICS OF CELLULOSE HYDROLYSIS BY ACIDS AND ENZYMES Final Report, 1 Jun. 1978 - 31 Jan. 1981
C. S. Gong and M. Chang Feb. 1981 172 p
(Contract DE-AC02-76ER-02755)
(DOE/ER-02755/5) Avail: NTIS HC A08/MF A01

There are three basic enzymes [e.g., endoglucanase (C/sub x/), exoglucanase (C1) and cellobiase] comprising the majority of extracellular cellulase enzymes produced by the cellulolytic mycelial fungi, Trichoderma reesei, and other cellulolytic microorganisms. The kinetics of cellobiase were developed on the basis of applying the pseudo-steady state assumption to hydrolyze cellobiose to glucose. The results indicated that cellobiase was bjected to end-product inhibition by glucose. The kinetic modeling of exoglucanase (C1) with respect to cellodextrins was studied. Both glucose and cellobiose were found to be inhibitors of this enzyme with cellobiose being a stronger inhibitor than glucose. Similarly, endoglucanase (C/sub x) is subject to end-product inhibition by glucose. Crystallinity of the cellulose affects the rate of hydrolysis by cellulases. Hence, the changes in crystallinity of cellulose in relation to chemical pretreatment and enzyme hydrolysis was compared. The study of cellulase biosynthesis resulted in the conclusion that exo-and endo-glucanases are coinduced while cellobiase is synthesized independent of the other two enzymes. DOE

N81-28574# Utah Univ., Salt Lake City. Earth Sciences Lab.
IPINV: A TWO-DIMENSIONAL DIPOLE-DIPOLE RESISTIVITY MODELING AND INVERSION PROGRAM. USER'S GUIDE AND DOCUMENTATION FOR REVISION 1
Alan C. Tripp and Terry J. Killpack Jan. 1981 52 p refs
(Contract DE-AC07-79ED-12079)
(DOE/ID-12079/25) Avail: NTIS HC A04/MF A01

The IPINV REV1 is a batch program that is capable of

inverting resistivity data to two dimensional models for a dipole/dipole array. The forward problem is computed using a transmission surface analog. The inversion algorithm is a linearized least squares technique. Step size stabilization is provided by either the Box-Kanemaesu method or by using a Marguardt step. The program uses log derivatives to decrease the rate of convergence. DOE

N81-28575# Institute of Gas Technology, Chicago, Ill. Energy Conversion Systems Group.

APPLICATIONS OF FUSION THERMAL ENERGY TO INDUSTRIAL PROCESSES

Ronald M. Bowman, Bassam J. Jody, and Kuang C. Lu 1980 20 p refs Presented at the 3d Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 15-17 Dec. 1980

(Contract W-31-109-eng-38)

(CONF-801210-24) Avail: NTIS HC A02/MF A01

The feasibility of applying fusion thermal energy as process heat in the iron-steel industry, petrochemical industry, cement industry, and in the production of acetylene from coal via calcium carbide are discussed. These four industries were selected for analysis because they require massive amounts of energy. This preliminary study concludes that the production of synthetic fuels using fusion heat appears to be the most promising method of storing and transporting this heat. Of the four industries studied, the iron-steel and the petrochemical industries appear to be the most promising because they consume substantial amounts of hydrogen and oxygen as feedstocks. These can be produced from water using the high temperature fusion heat. The production of hydrogen and oxygen using fusion heat will also reduce the capital investment required for these industries. These two industries also consume tremendous amounts of heat at temperatures which can be delivered from a fusion blanket via chemical heat pipes. DOE

N81-28576# Southwest Research and Development Co., Las Cruces, N. Mex.

ECONOMICS OF WIND ENERGY FOR IRRIGATION PUMPING Final Report

R. R. Lansford, R. J. Supalla, J. R. Gilley, and D. L. Martin 14 Jul. 1980 89 p refs Sponsored in part by Dept. of Agriculture

(Contracts DE-A101-76ET-20319; EX-76-A-29-1026)

(DOE/SEA-7315-2074/81/2) Avail: NTIS HC A05/MF A01

The economic questions associated with wind power as an energy source for irrigation under different situations with seven regions of the nation were studied. Target investment costs for wind turbines used for irrigation pumping and policy makers with bases for adjusting taxes to make alternative sources of energy investments more attractive are analyzed. Three types of wind systems are considered for each of the seven regions. The three types of wind powered irrigation systems evaluated for each region are: (1) wind assist combustion engines (diesel, natural gas, propane panel); (2) wind assist electric engines, with or without sale of surplus electricity; and (3) stand alone reservoir systems with gravity flow reservoirs. DOE

N81-28577# Purdue Univ., Lafayette, Ind.

RESEARCH ON STOCHASTIC POWER-FLOW STUDY METHODS Final Report, 1 May 1977 - 31 Jul. 1980

G. T. Heydt, ed. Jan. 1981 855 p refs

(Contract DE-AC02-77ET-29102)

(DOE/ET-29102/1) Avail: NTIS HC A99/MF A01

A general algorithm to determine the effects of uncertainty in bus load and generation on the output of conventional power flow analysis is presented. The transformation of the uncertainty through the power flow equations is made by the expansion of the node equations in a multivariate Taylor series about an expected operating point. The series is truncated after the second order terms. The second order transformation offers a correction vector and allows the consideration of larger uncertainties which have caused significant error in the current linear transformation algorithms. Voltage controlled busses are included with consideration of upper and lower limits. A method is given which considers limitation constraints in the evaluation of all outputs quantities. The algorithm supplies information about severity of overload as well as probability of occurrence. An example is given for an eleven bus system, evaluating each quantity separately. DOE

N81-28578# California Univ., Berkeley. Lawrence Berkeley Lab. Energy Efficient Buildings Program.

TEST RESULTS AND METHODS: RESIDENTIAL AIR-TO-AIR HEAT EXCHANGERS OR MAINTAINING INDOOR AIR QUALITY AND SAVING MONEY

William J. Fisk, Gary D. Roseme, and Craig D. Hollowell Feb. 1981 18 p refs Presented at the 1st Intern. Energy Agency Conf. on New Energy Conserv. Technol. and their Commercialization, Berlin, 6-10 Apr. 1981

(Contract W-7405-eng-48)

(LBL-12280; CONF-810423-4) Avail: NTIS HC A02/MF A01

Results obtained on five different residential heat exchangers are presented. The performance criteria and the test facility are described. The performance paramaters measured were: heat exchanger effectiveness (a measure of heat transfer ability); airstream static pressure drop; and fan system performance. The performance of the five heat exchangers differed greatly. The resistance to air flow varied by a factor of two. One of the heat exchangers was highly susceptible to leakage between airstreams and one had an unstable performance. DOE

N81-28579# California Univ., Livermore. Lawrence Livermore Lab.

CALIFORNIA ENERGY FLOW IN 1979

C. K. Briggs and I. Y. Borg 31 Mar. 1981 18 p refs

(Contract W-7405-eng-48)

(UCID-18991) Avail: NTIS HC A02/MF A01

Energy use in California during 1979 differed significantly from 1978. Overall use of natural gas in the state increased substantially (14.3%) due principally to greater use for electrical power production; 4% more gas was used for electrical power generation in 1979 than in 1978 and 21% more than in 1977. Use of fuel oil for electrical generation remained at the 1978 level but below the high 1977 level, which reflected substitution of oil for hydroelectric power during the 1976 to 1977 drought. Together, oil and gas accounted for 80% of the fuels used to generate electricity. Crude-oil imports principally from Indonesia fell substantially; however, use of Alaskan North Slope oil increased so that the net increase in crude oil use was up about 4%. The transportation end-use sector consumed about as much as in 1978 despite shortages in early 1979 associated with the Iranian revolution. While sales fell slightly, sales of high-sulfur residual oils (Bunker C) increased markedly. Transportation represents 38% of total energy consumption in California. DOE

N81-28580# Institute of Gas Technology, Chicago, Ill.

STATUS OF MOLTEN CARBONATE FUEL CELL TECHNOLOGY

L. G. Marianowski and John B. OSullivan 1981 16 p refs Presented at the 8th Energy Technol. Conf. and Exposition, Washington, D.C., 9-11 Mar. 1981 Sponsored in part by General Electric Co., DOE, Electric Power Research Inst. and the Gas Research Inst.

(CONF-810315-8) Avail: NTIS HC A02/MF A01

A molten carbonate fuel cell integrated with a coal gasification power plant is one of the most promising coal-using technologies because of its high efficiency acceptable cost, and environmental acceptability. The high temperature heat available from the fuel cell may be used in a bottoming cycle and/or industrial cogeneration applications; however, for the molten carbonate system to achieve these goals, continued developmental work is required which must take account of the operating conditions of the application. The progress made in improving cell performance and life and in producing inexpensive cell components is discussed. The status, direction, and priority of future research and engineering efforts is also discussed. DOE

N81-28581# Brookhaven National Lab., Upton, N. Y.

ZIRCONIA FUEL CELLS AND ELECTROLYZERS

H. S. Isaacs 1980 26 p refs Presented at the 1st Intern. Conf. on the Sci. and Technol. of Zirconia, Cleveland, 16 Jun. 1980

(Contract DE-AC02-76CH-00016)

(BNL-29133; CONF-8006157-1) Avail: NTIS HC A03/MF A01

A review of the historical development, operation, and

problems of solid oxide electrolyte fuel cells and electrolyzers is given. The thermodynamic principles of operation are reviewed, and the overvoltage losses during operation of fuel cells and steam electrolyzers are discussed including physical factors and electrochemical factors. DOE

N81-28582# Stanford Univ., Calif. Dept. of Operations Research.

ETA-MACRO: A USER'S GUIDE

A. S. Manne Feb. 1981 138 p

(EPRI Proj. 1014)

(EPRI-EA-1724) Avail: NTIS HC A07/MF A01

The ETA-MACRO model is designed to estimate the extent of two way linkage between the energy sector and the balance of the economy. It represents a merger between ETA (a process analysis for energy technology assessment) together with a macroeconomic growth model providing for substitution between capital, labor, and energy inputs. The ETA-MACRO allows explicitly for: (1) energy economy interactions; (2) cost effective conservation; (3) interfuel substitution, and (4) new supply technologies, each with its own difficulties and uncertainties on dates and rates of introduction. This user's guide includes an overview of the model, an illustrative application to long term US energy projections, and technical descriptions of the macro and ETA submodels. It also includes an analysis of how market penetration rates may be related to the profitability of new technologies. Finally, the appendices provide a detailed guide to the computer implementation. DOE

N81-28583# SRI International Corp., Menlo Park, Calif. Electrochemistry Group.

WORKSHOP ON ELECTRODES FOR FLOWING SOLUTION BATTERIES

Leonard Nanis Feb. 1981 58 p refs Presented at the Workshop on Electrodes for Flowing Solution Batteries, Tampa, Fla., 5-7 Nov. 1979

(EPRI-WS-79-192; CONF-7911140-Summ) Avail: NTIS HC A04/MF A01

The electrochemical technology of aqueous secondary cells with flowing electrolyte solutions was addressed. Emphasis was placed on the significant parameters believed to govern the performance of the two basic types of electrodes now in use: a porous flow through electrode (PFTE), and an impervious flow by electrode. Progress, problems, and prospects were informally discussed. Key topics included: (current distribution in FTPE; conversion efficiency, segmented FTPE studies; general discussion on FTPE parameters; surface activation; application of FTPE to waste recovery; Exxon zinc bromine flow by system, FTPE in NASA redox energy storage; and application of FTPE in Lockheed zinc ferricyanide redox system). In generally comparing flow through to flow by electrodes, there were some surprising differences arising from experimental results that did not fit conventional thinking. DOE

N81-28584# Midwest Research Inst., Golden, Colo. Building Systems Div.

OVERVIEW OF VALIDATION PROCEDURES FOR BUILDING ENERGY-ANALYSIS SIMULATION CODES

David Wortman, Bob ODoherty, and Ron Judkoff Mar. 1981 5 p refs Presented at Ann. Conf. of the Intern. Solar Energy Soc., Philadelphia, 26 May, 1981

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TP-721-1133; CONF-810509-12) Avail: NTIS HC A02/MF A01

A procedure for the validation of Building Energy Analysis Simulation Codes (BEAS) is described. These codes are used increasingly in the building design process, both directly and as the basis for simplified design tools and guidelines. The importance of the validity of the BEAS in predicting building energy performance is obvious when one considers the money and energy which could be wasted by energy-inefficient designs. The validation work consists of three distinct parts: comparative study; anaytical verification; and empirical validation. DOE

N81-28585# University of Southern California, Los Angeles. Dept. of Petroleum Engineering.

SCALED PHYSICAL MODEL STUDIES OF THE STREAM DRIVE PROCESS Annual Report, Sep. 1978 - Sep. 1979

T. M. Dosher Feb. 1981 82 p refs

(Contract DE-AT03-76ET-12075)

(DOE/ET-12075/2; AR-2) Avail: NTIS HC A05/MF A01

The role of two important controllable parameters, viz., steam injection rate and steam quality and the role of two important factors, oil viscosity and reservoir permeability on the performance of the steam drive were explored. The influence of bottom water and a basal permeable layer were also investigated. There is an optimum injection rate; in the vicinity of this optimum an increased quantity results in improved oil steam ratios; the viscosity of the oil at steam temperature, raised to a fractional power, 0.5, correlates with oil production; permeabilities in the darcy range have little effect on performance but an increasing one with low viscosity oil, and that bottom water, which facilitates injection, results in poorer early performance but one which eventually rivals the oil/steam ratio of a uniform reservoir at a somewhat higher recovery of original oil in place. The major value of the physical model is to describe the role of the reservoir and operational parameters of a class of steam drive operations. DOE

N81-28586# Sandia Labs., Albuquerque, N. Mex.

INCENTIVES FOR SOLAR ENERGY IN INDUSTRY

Kenneth D. Bergeron May 1981 33 p refs

(Contract DE-AC04-76DP-00789)

(SAND-81-0048) Avail: NTIS HC A03/MF A01

Several issues are analyzed on the effects that government subsidies and other incentives have on the use of solar energy in industry, as well as on other capital-intensive alternative energy supplies. Discounted cash flow analysis is used to compare tax deductions for fuel expenses with tax credits for capital investments for energy. The result is a simple expression for tax equity. The effects that market penetration of solar energy has on conventional energy prices are analyzed with a free market model. It is shown that net costs of a subsidy program to the society can be significantly reduced by price. Several government loan guarantee concepts are evaluated as incentives that may not require direct outlays of government funds; their relative effectiveness in achieving loan leverage through project financing, and their cost and practicality, are discussed. DOE

N81-28587# Battelle Pacific Northwest Labs., Richland, Wash.

PHOTOVOLTAICS

J. E. Garnier Apr. 1981 31 p refs Prepared for Washington Univ., Bellingham

(Contract DE-AC06-76RL-01830)

(PNL-SA-9464) Avail: NTIS HC A03/MF A01

Drawings, graphs, and brief notes are presented. They are used to outline the theory of solar cells and the national photovoltaic program. DOE

N81-28588# Sandia Labs., Albuquerque, N. Mex.

IMPLEMENTATION PLAN (MAY 1979): BATTERIES FOR SPECIFIC SOLAR APPLICATIONS

Robert P. Clark Apr. 1981 18 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-0216) Avail: NTIS HC A02/MF A01

The scope and objectives of the batteries for specific solar applications Project (BSSAP) are discussed. The BSSAP consists of five major tasks: (1) Battery Requirements Analysis, (2) Laborator Evaluation; (3) Photovoltaic Advanced Systems Tests; (4) Photovoltaic Applications Experiments; and (5) Battery Research and Development. All five tasks are described, and the schedule and milestones for completing each task are listed. Requirements for annual reporting and reviews are specified, and the ESSAP is linked to the existing Sandia/DOE PV Project. DOE

N81-28589# Institute for Telecommunication Sciences, Boulder, Colo.

EXAMINATION OF SOME HYPOTHETICAL SPS RECTENNA SITE WITHIN THE CONTIGUOUS UNITED STATES OF AMERICA. PART 1: PRECIPITATION EFFECTS ON HYPOTHETICAL SPS SITES IN THE USA. PART 2: POINT-TO-POINT MICROWAVE AND SERVICE MODE COMMUNICATIONS SYSTEMS NEAR FOUR HYPOTHETICAL SPS RECTENNA SITES IN THE CONTINENTAL UNITED STATES

E. J. Dutton and B. D. Warner May 1981 38 p refs
(Contract DE-AC01-80ER-10160)
(DOE/ER-10160/T4) Avail: NTIS HC A03/MF A01

THE EMC (electromagnetic compatibility) problems for the candidate SPS rectenna site in the Mojave Desert of California was studied. The precipitation effects at nine other hypothetical SPS rectenna sites and the licensed transmitter density at four proposed SPS rectenna sites were examined. The results of the precipitation study indicate that the transmission loss will not vary by more than 3% from site to site for the nine sites considered. Results of the licensed transmitter study for four sites support the contention that a strong correlation exists between population density and operational communications systems within a small area (150 Km x 150 Km). DOE

N81-28590# Public Technology, Inc., Washington, D. C.
LOCAL GOVERNMENT GUIDE TO THE EMERGING TECHNOLOGIES OF COGENERATION AND PHOTOVOLTAICS. ENERGY TECHNOLOGY REPORT OF THE ENERGY TASK FORCE OF THE URBAN CONSORTIUM
1980 44 p refs Prepared in cooperation with Planning and Management Associates of Greater Washington, Inc., Washington, D.C.
(Contract DE-FG02-78IR-05106)
(DOE/IR-05106/T24) Avail: NTIS HC A03/MF A01

An overview of cogeneration and photovoltaic systems is presented to provide local government managers a basic understanding of the technologies. Issues and considerations associated with applications are presented. Discussions cover installation and maintenance requirements, equipment availability, costs, and risks/benefits. Data describing demonstration sites and contacts for further information are provided. DOE

N81-28591# California Energy Commission, Sacramento.
DIFFUSION OF SOLAR ENERGY TECHNOLOGIES IN THE NEW-CONSTRUCTION MARKET: A SURVEY OF NEW SOLAR-HOME AND CONVENTIONAL-HOME BUYERS
Diana Rains, Deborah Dunipace, and C. K. Woo Feb. 1981 64 p
(DOE/EIA-10189/T2) Avail: NTIS HC A04/MF A01

Consumer motivations for choosing a solar energy equipped home when the nonsolar or conventional model was available were investigated. The approach was to test the relative importance of demographic, dwelling unit, and heating system characteristics in household decisions to purchase a home equipped with solar energy devices. Two statistical models were developed: one to examine the relationship between the types of home buyers (as an identifiable market segment) and the decision to purchase a solar home; and the other to compare the energy use of solar vs. conventional homes selected in the sample. DOE

N81-28592# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
GEOTHERMAL ENERGY FOR HAWAII: A PROSPECTUS
Winifred W. S. Yen and Daniel S. Iacofano Jan. 1981 97 p refs
(Contract W-7405-eng-48)
(LBL-12184) Avail: NTIS HC A05/MF A01

An overview of geothermal development is provided for contributors and participants in the process: developers, the financial community, consultants, government officials, and the people of Hawaii. Geothermal energy is described along with the issues, programs, and initiatives examined to date. Hawaii's future options are explored. Included in appendices are: a technical glossary, legislation and regulations, a geothermal directory, and an annotated bibliography. DOE

N81-28593# Westinghouse Research and Development Center, Pittsburgh, Pa.
LOW-COST EVACUATED-TUBE SOLAR COLLECTOR Final Report
10 Feb. 1981 262 p refs
(Contract DE-AC04-78CS-30133)
(DOE/CS-30133/T1-Vol-1) Avail: NTIS HC A12/MF A01

A prototype design for an evacuated tube air cooled solar collector module was completed. A product cost study, based on the production of 60,000 of the prototype modules per year (approx. 1,000,000 square feet annually), estimates that the module as shipped would have a cost at inventory of $7.09 to $7.40 per square foot of aperture. Computer programs were developed to predict the optical and thermal performane of the module. Antireflective coatings (porous aluminum oxide) formed by spraying or dipping were demonstrated but degraded more rapidly when exposed to a high humidity ambient acid etched films. A selective black chromium oxide multi-layered graded film was vapor deposited which had an absorptivity of about 0.9 and an emissivity of 0.03. When the film was heated to temperatures of 4000 C in a gettered vacuum for as little as 24 hours, however, irreversible changes took place both between and within coating layers which resulted in alpha decreasing to about 0.73 and epsilon increasing to 0.14. DOE

N81-28594# Los Alamos Scientific Lab., N. Mex.
GEOTHERMAL RESOURCE BASE OF THE WORLD: A REVISION OF THE ELECTRIC POWER RESEARCH INSTITUTES ESTIMATE
M. J. Aldrich, A. W. Laughlin, and D. T. Gambill Apr. 1981 60 p refs
(Contract W-7405-eng-36)
(LA-8801-MS) Avail: NTIS HC A04/MF A01

Calculating methods for the geothermal resource base of a country show that modifications are needed for the assumptions used in the calculation. The modifications include: (1) separating geothermal belts into volcanic types with a geothermal gradient; (2) using the actual mean annual temperature of a country; and (3) making separate calculations for the resource stored in water/brine and that stored in rock. It is indicated that the method for geothermal resource base calculations yields reasonable values. DOE

N81-28595# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
ACCELEROMETER MEASUREMENTS OF AERODYNAMIC TORQUE ON THE DOE/SANDIA 17-M VERTICAL AXIS WIND TURBINE
Gerald M. McNerney Apr. 1981 20 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2776) Avail: NTIS HC A02/MF A01

An experiment on the 17 m Vertical Axis Wind Turbine, using rotor shaft torque and rotor angular acceleration data to deduce the functional form of the aerodynamic torque was conducted. An analysis of the experiment, along with errors encountered, is presented and the results are listed in both graphic and analytical form. DOE

N81-28596# Massachusetts Building Code Commission, Boston.
ENERGY-CONSERVATION OPPORTUNITIES IN LIGHTING
Apr. 1981 34 p
(Contract DE-FG01-79CS-60467)
(DOE/CE-60467-02) Avail: NTIS HC A03/MF A01

Technologies and techniques employed to reduce lighting costs by as much as 70 percent are discussed. Four basic steps to reduce energy costs and improve the effectiveness of the lighting system discussed are: (1) acquaintance with some of the basic terminology and energy efficient lamps and fixtures which are on the market; (2) conducting a survey of the building to determine where and how much energy and money can be saved; (3) implementation of the simple, low cost or no cost measures; and (4) calculation of the payback period for capital investment modifications, and implementation. DOE

N81-28597# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
BIOCONVERSION OF CELLULOSE. WORK PROGRESS FOR FY 1980
Charles R. Wilke and Harvey W. Blanch Mar. 1981 75 p
(Contract W-7405-eng-48)
(LBL-12602) Avail: NTIS HC A04/MF A01

Progress is reported on the following: kinetic and mechanistic studies on cellulose enzymes, yeast nutrition, models of yeast growth and ethanol inhibition, by product inhibition in cell recycle and vacuum fermentation, hollow fiber reactor, thermodynamics of ethanol water systems, novel ethanol water separations, and simultaneous and sequential cellulose fermenting organisms. DOE

N81-28598# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
ENERGY RESEARCH. SCIENTIFIC STATUS REPORT Status Report, 1980 [FORSCHUNGSBEREICH ENERGETIK. WISSENSCHAFTLICHER BERICHT - STAND 1980]
Hans Joachim Holtz, ed. 1981 107 p refs In GERMAN Original contains color illustrations
Avail: NTIS HC A06/MF A01

The first work group reports on solar thermal power stations, solar energy resources, tubular collector designs, and heliostat designs, low pressure Cs diodes, cermet emitters, and thermionic converters as well as hydrogen storage and cryoadsorbents are also discussed. Applications of gas dynamic CO lasers, plasma physics, and Lyman transitions of hydrogen atoms are covered. The RIT-10 RF thruster system, thruster components, and the detection of oil breakdown in aircraft engines are touched on as well. Activities of the second group include studies of HF vibrational relaxation in a shock tube, hydrogen production, thermal decomposition of SO2, and flame quenching and exhaust hydrocarbons in a combustion chamber. The energy of diatomic molecules, local temperature measurements in flames, laser Raman spectroscopy, and absolute transition probabilities and particle densities from saturated fluorescence excitation are also dealt with. Investigations of the third group involve analytical mass modeling of chemical rocket stages for space flight, development of chemical propulsion modules and a propulsor platform for low altitude payload delivery. Author (ESA)

N81-28599# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
A PRELIMINARY THEORETICAL STUDY OF DOUBLE BLADE TWO-DIMENSIONAL AERODYNAMICS FOR APPLICATIONS TO VERTICAL AXIS WIND TURBINES Final Report
Erling Weibust 21 Apr. 1981 69 p refs
(Contracts PE-450-01; NE-5061-451)
(FFA-TN-AU-1635) Avail: NTIS HC A04/MF A01

A NASA model for computing the subsonic, viscous, attached flow around multielement airfoils was used to determine the amount of energy lost when using double blades rather than single ones. The resulting tangential force for the double or single blade configuration used as a criterion is found. Radial spacing, toe-in toe-out angle and tangential displacement (stagger) were varied to see how tagential force is affected. The greatest tangential force values are found to be achieved for maximum allowable radial spacing, which is determined by structural considerations, and is assumed to be on the order of 1.5 c. At this rather large distance, stagger as well as toe-in toe-out angle only gives slight improvements as long as the flow separation effects (stall region) are not considered. A large part of the energy is captured at relatively high wind speeds when the flow on the blades is partly separated (stalled). Author (ESA)

N81-28600# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
SAFETY AND WIND ENERGY CONVERSION SYSTEMS WITH HORIZONTAL AXIS (HA WECS)
Sigge Eggwertz, Ingemar Carlsson, Anders Gustafsson, Magnus Linde, Christer Lundemo, Bjoern Montgomerie, and Sven-Erik Thor 19 Mar. 1981 170 p refs
(Contract NE-5061)
(FFA-TN-HU-2229) Avail: NTIS HC A08/MF A01

Hazards imposed by a wind energy conversion system on the general public and on the operator personnel by complete collapse, by separation of fractured parts, or by pieces of ice (flying off) were calculated to provide a manual for safety evaluations. Land based large scale turbine systems with horizontal axes situated in areas with sparse population are considered. Blade material is assumed to be steel, aluminum alloy or fiber reinforced plastics; the tower being built of steel or reinforced concrete. Primary structure, function and failure modes are identified. Statistical information of loads and load combinations, strength properties of materials and geometry deviation are provided. A simplified method of risk analysis is described. The object and function of a safety system, both hardware and software, is reviewed, considering the effects of inspection and repair. The probability of being hit is evaluated, provided a fracture occurs and a risk zone is established. Author (ESA)

N81-28601# Indian Lead Zinc Information Centre, New Delhi.
SYMPOSIUM ON BATTERY SYSTEMS IN THE 1980'S
Nov. 1980 85 p refs Symp. held at New Delhi, 26 Feb. 1979
(PB81-123689) Avail: NTIS HC A05/MF A01 CSCL 10C

The status of the battery industry in the country is discussed. A realistic assessment of the emerging trends in battery technology is presented. While acknowledged experts in the fields of lead acid batteries from India and abroad presented papers covering comprehensively the different aspects of battery systems, the participants were senior executives, technologists and government officials from user and producer interests. Representing the producer interests were the producers of lead and zinc and battery manufacturers. The symposium afforded an opportunity for not only exchange of information but also for cross-fertilization of ideas. GRA

N81-28602# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY DEVELOPMENT IN THE EASTERN UNITED STATES. PAPERS PRESENTED: GEOTHERMAL RESOURCES COUNCIL ANNUAL MEETING
Oct. 1980 48 p refs
(Contracts EX-76-A-36-1008; DE-AI01-79ET-27025)
(PB81-165235; JHU/APL/QM-80-134) Avail: NTIS HC A03/MF A01 CSCL 08I

Topic areas covered include: technical assistance (hydrothermal resource application in the eastern United States); GRITS - a computer model for economic evaluation of direct-uses of geothermal energy; geothermal market penetration in the residential sector - capital stock impediments and compensatory incentives; an analysis of benefits and costs of accelerated market penetration by a geothermal community heating system. GRA

N81-28603# National Bureau of Standards, Washington, D.C. Center for Building Technology.
WIND, EARTHQUAKE, SNOW, AND HAIL LOADS ON SOLAR COLLECTORS
Louis Cattaneo, James Robert Harris, Timothy A. Reinhold, Emil Simiu, and Charles W. C. Yancey Jan. 1981 95 p refs Sponsored in part by DOE
(PB81-164550; NBSIR-81-2199) Avail: NTIS HC A05/MF A01 CSCL 10A

Wind-tunnel, full-scale, and field studies of wind and snow loads on flat plate solar collectors are described and results are used to develop information, guidelines, and criteria for the design of flat plate collectors subjected to the action to wind, snow, and earthquake loads. Also given are data on hail loads, based on information and studies available in the literature. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-28604 Wisconsin Univ. - Madison.
COOLING WATER DISCHARGE INTO FLOODPLAIN MEADOWS AND MARSHES: EFFECTS, MECHANISMS, AND IMPLICATIONS FOR ENVIRONMENTAL ANALYSIS Ph.D. Thesis
Barbara Lynn Bedford 1980 190 p
Avail: Univ. Microfilms Order No. 8110062

An assessment of the effects on sedge meadow and shallow marsh vegetation of water leaking from the cooling lake of a coal-fired electric generating station is presented. Results show marked changes in wetland plant populations and community structure within one year after the generating station began operation. Measures of species richness and diversity fluctuated markedly but showed no consistent relationship to disturbance. A trend of decreasing vegetative cover occurred. The response of Typha Latifolia and Carex lacustris was related to altered seasonal patterns of carbohydrate storage and shoot phenology induced by ground-water temperatures out of phase with normal cycles of plant growth. The implications of plant growth strategy for monitoring and predicting population response to disturbance are discussed. A conceptual model developed to relate cooling

water discharge to plant community structure and wetland system function is used to examine how further changes of the type indicated by trends in the population and community data night affect the functioning of the wetland as a peat-accumulating system within the floodplain. Dissert. Abstr.

N81-28605 Purdue Univ., Lafayette, Ind.
SHORT TERM MATHEMATICAL MODELS FOR AIR POLLUTION Ph.D. Thesis
Velasquez Bedoya 1980 217 p
Avail: Univ. Microfilms Order No. 8113647

An extensive air monitoring project collected data including power plant parameters, meteorology, and sulfur dioxide concentrations throughout the State of Indiana. Sigma theta, the standard deviation of wind direction, was computed by either the sigma meter readings or using the instantaneous wind direction readings. The stability class of the atmosphere was determined by using a net radiation scheme in conjunction with the hour of day and wind speed, and in addition by using a scheme based on the values of sigma theta. The best correlation coefficients correspond to Fairbanks, Edwardsport, and Evansville, in that order. Prediction of maximum peaks and better prediction of low levels at short distances away from plume centerline were the prime variables to be considered in any short term model. An improvement on these two variables would bring the models closer to the actual measurements. Dissert. Abstr.

N81-28606*# National Aeronautics and Space Administration, Washington, D. C.
NATURE OF THE ANNOYANCE AND NOISE ANNOYANCE RELATION AROUND AIRPORTS
Jacques Francois May 1981 27 p refs Transl. into ENGLISH from Rev. d'Acoustique (France), v. 12, no. 48, 1979 p 70-78 Original language document was announced as A80-30814 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75873) Avail: NTIS HC A03/MF A01 CSCL 13B

A survey of 5,000 individuals living around Orly Airport is described. The psobic index was used as the noise index which indicated the intensity of the annoyance experienced by people living around the airport. The results indicate that sensitivity to noise is related to certain personal factors. E.A.K.

N81-28607*# National Aeronautics and Space Administration, Washington, D. C.
ASPECTS OF ANNOYANCE DUE TO NOISE OF ROAD TRAFFIC. SURVEY RESULTS AT 10 SITES
May 1981 51 p refs Transl. into ENGLISH of "Aspects de la Gene due au Bruit de la Circulation Routiere. Resultats d'Enquetes sur 10 Sites" Paris, Feb. 1976, p 1-125 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Ministere de l'Equipment (SETRA) and CERN (Paris)
(Contract NASw-3198)
(NASA-TM-76561) Avail: NTIS HC A04/MF A01 CSCL 13B

Results of surveys per highway site are given. A discussion is given of factors studied such as contribution of various noise sources, variation of noise levels at different sites, times and activities disturbed, and noise level and annoyance. J.M.S.

N81-28608*# National Aeronautics and Space Administration, Washington, D. C.
INCIDENCES FROM MODIFICATIONS OF THE COMPUTATIONAL METHODS OF THE PSOPHIC INDEX
Jacques Francois May 1981 32 p Transl. into ENGLISH of "Incidences des Modifications de la Methode de Calcul de l'Indice Psophique" rept. Inst. Francais Publique, Paris, Nov. 1975 p 1-26 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76577) Avail: NTIS HC A03/MF A01 CSCL 13B

In France, the level of annoyance in areas around airports is represented by the psophic index N. Various modifications were proposed in the method of calculating this indexing order to improve the index as an annoyance indicator. The quality of the modified N index as a prognosis index for annoyance caused by aircraft noise is included. T.M.

N81-28609*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE EFFECTS OF NOISE ON RESIDENTS
May 1981 9 p Transl. into ENGLISH of "Etude des Effets de Bruit sur les Habitants" rept. (Bron) p 1-8 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Recherche des Nuisances, Bron (France)
(Contract NASw-3199)
(NASA-TM-76578) Avail: NTIS HC A02/MF A01 CSCL 13B

A survey questionnaire is presented which was used to study the effects of noise on residents such as that from automobile traffic. A.R.H.

N81-28610*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF THE DISTURBANCE CAUSED BY AIRCRAFT NOISE BY OPINION SURVEYS
Jacques Bremond May 1981 17 p refs Transl. into ENGLISH from Med. Aeron. et Spatiale, Med. Subaquatique et Hyperbare (France), v. 18 no. 72, 1979 p 269-274 Original language document was announced as A80-32597 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76579) Avail: NTIS HC A02/MF A01 CSCL 13B

A survey on the disturbance caused by aircraft noise was evaluated. The use of a questionnaire as a scale rather than considering isolated question responses is seen as more objective. A standardized structure for questionnaires of the opinion surveys on aircraft noise, which includes a set of questions permitting the analysis of the disturbance caused by different daily activities is recommended. The statistical processing of the answers, to achieve the most reliable evaluation of disturbance felt are discussed. E.A.K.

N81-28611*# Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.
INVESTIGATION OF POTENTIAL OF DIFFERENTIAL ABSORPTION LIDAR TECHNIQUES FOR REMOTE SENSING OF ATMOSPHERIC POLLUTANTS Final Report, 15 Dec. 1978 - 14 Jun. 1980
Carolyn F. Butler, Scott T. Shipley, and Robert J. Allen Jul. 1981 108 p refs
(Grant NsG-1477)
(NASA-CR-164645; GSTR-81-8) Avail: NTIS HC A06/MF A01 CSCL 13B

The NASA multipurpose differential absorption lidar (DIAL) system uses two high conversion efficiency dye lasers which are optically pumped by two frequency-doubled Nd:YAG lasers mounted rigidly on a supporting structure that also contains the transmitter, receiver, and data system. The DIAL system hardware design and data acquisition system are described. Timing diagrams, logic diagrams, and schematics, and the theory of operation of the control electronics are presented. Success in obtaining remote measurements of ozone profiles with an airborne systems is reported and results are analyzed. A.R.H.

N81-28612*# Eaton Corp., Melville, N.Y.
DESIGN, DEVELOPMENT, AND FIELD TESTING OF INFRARED HETERODYNE RADIOMETER (IHR) FOR REMOTE PROFILING OF TROPOSPHERIC AND STRATOSPHERIC SPECIES Final Report
R. Lange, M. Savage, and B. Peyton Washington NASA 1981 102 p refs
(Contract NAS1-13223)
(NASA-CR-3448; A610-IV) Avail: NTIS HC A06/MF A01 CSCL 13B

The performance of a dual-channel infrared heterodyne radiometer, designed to remotely monitor the concentration and vertical distribution of selected atmospheric species, is described. Ground based solar viewing measurement using the IHR were performed at selected laser transitions for ammonia (NH3 and ozone O3). Flight tests were conducted aboard the Gallelio II, NASA Ames CV-990, on the Latitude Survey Mission. Ozone

was the selected atmospheric species for the airborne flight measurements because of the scientific interest in this atmospheric species, the availability of in situ monitors, the coordinated ozone measurements, and the availability of ground truth data. The IHS was operated in the solar viewing mode to determine ozone distributions in the stratosphere and in the nadir viewing mode to determine the ozone distribution in the troposphere. Airborne atmospheric propagation measurements also were carried out at selected CO2 laser transitions. A.R.H.

N81-28613# Committee on Commerce, Science, and Transportation (U. S. Senate).
ENVIRONMENTAL EMERGENCY RESPONSE ACT
Washington GPO 1980 270 p refs Hearings on S. 1480 before the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 11-12 Sep. 1980
(GPO-69-714) Avail: Committee on Commerce, Sciences, and Transportation

A bill to provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and for the cleanup of inactive hazardous waste disposal sites is examined with particular emphasis on the impact of the legislation on transportation and commerce. A.R.H.

N81-28614*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL QUALITY PROGRAM REVIEW
23 Jan. 1979 67 p Meeting held in Greenbelt, Md., 23 Jan. 1979
(NASA-TM-80461) Avail: NTIS HC A04/MF A01 CSCL 13B

The transcript of discussions held following formal presentations during sessions 4 and 5 of the program review are presented. Topics covered include global and regional tropospheric research and water quality. Plans for continued study are indicated. A.R.H.

N81-28615*# Research Triangle Inst., Research Triangle Park, N. C. Systems and Measurements Div.
DATA QUALITY: 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY (SEV-UPS): SURFACE AND AIRBORNE STUDIES Final Report
J. H. White, R. B. Strong, M. L. Saeger, W. C. Eaton, and J. B. Lommerdahl Washington NASA Jul. 1981 66 p refs
(Contract NAS1-15827)
(NASA-CR-3450; RTI/1816/03-01F) Avail: NTIS HC A04/MF A01 CSCL 13B

The SEV-UPS field study conducted during August 1979 involved the coordinated air quality data collection efforts of three different organizations operating a total of four aircraft and 12 ground stations. Incorporated into plans for that program were numerous quality assurance activities designed to identify potential hazards for data quality in time for their correction and to take data to allow assessment of the consistency of the data from different stations. The purpose of this study was to document QA procedures that were performed by participating agencies and revise data from all platforms for mutual compatibility. For the latter effort, cases were identified on 21 occasions on seven different days where two or more monitoring systems were operating in the same location at nearly the same time. Data from the systems involved were tabulated in 200 m altitude segments, averaged and compared to detect any bias between measurements made from different systems. The results of these comparisons along with the results of independent performance audits are presented. Author

N81-28616# Air Force Geophysics Lab., Hanscom AFB, Mass. Terrestrial Sciences Div.
THE SEISMO-ACOUSTIC DISTURBANCE PRODUCED BY A TITAN 3-D WITH APPLICATION TO THE SPACE TRANSPORTATION SYSTEM LAUNCH ENVIRONMENT AT VANDENBERG AFB Scientific Interim Report
Francis A. Crowley, Eugene B. Hartnett, and Henry A. Ossing 17 Nov. 1980 73 p refs
(AF Proj. 7600)
(AD-A100209; AFGL-TR-80-0358; AFGL-TR-AFSG-434) Avail: NTIS HC A04/MF A01 CSCL 20/1

A vibro-acoustic study of a Titan 3-D rocket launch was conducted at Vandenberg AFB for the purpose of predicting the seismic and acoustic fields for future Space Transportation System launches. The resulting vibro-acoustic forecasts are configured to permit vibration estimates within critical STS ground facilities. It was determined that rocket-induced ground motion is dominated by the complex branch of the air-coupled wave, and that the surface pressure travels as a nondispersive, spacially coherent acoustic load over the distances and frequencies of concern. Author (GRA)

N81-28617# Washington Univ., Seattle.
GEOCHEMICAL DETERMINATION OF BIOSPHERIC CO2 FLUXES TO THE ATMOSPHERE Annual Progress Report, 1 Jun. 1979 - 31 Aug. 1981
Minze Stuiver 24 Mar. 1981 95 p refs
(Contracts DE-AT06-79EV-10206; DE-AM06-76RL-02225)
(DOE/EV-10206/2) Avail: NTIS HC A05/MF A01

Aspects of the carbon cycle are reported through the use of C13/C12 and C14/C12 abundance ratios. Knowledge of past biospheric carbon reservoir changes that resulted in increases or reductions of atmospheric CO2 levels was increased. Carbon 13 trends in trees from Kodiak Island, Alaska, and Chile were determined. DOE

N81-28618# Alaska Univ., Fairbanks. Interim Report
CARBON DIOXIDE IN ARCTIC AND SUBARCTIC REGIONS
T. A. Gosink and J. J. Kelley Feb. 1981 23 p refs
(Contract DE-AT06-80EV-10429)
(DOE/EV-10429/2) Avail: NTIS HC A02/MF A01

Sea surface water partial pressures of CO2 between Greenland and Franz Joseph's Land were investigated. It was found that: (1) extensive low partial pressures of CO2 exist in surface waters; (2) low partial pressures extend farther to the north and to the west; (3) penetration depth of very low partial pressures and equilibrium depth was estimated; (4) an empirical method for determination of PCO2 in sea water was confirmed; (5) invasion rate of CO2 across cold Arctic surface water was estimated; (6) the Barents-Kara-Lapter Norwegian Seas area are enormously strong sinks, absorbing ca. 2 x 10 to the 15th power g CO2, during summer months; and (7) the Arctic is an annual set sink of 1 x 10 to the 15th power g CO2 per year. E.A.K.

N81-28619# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
RECENT DEVELOPMENTS IN THE ANALYSIS OF AIR SAMPLES BY LUMINESCENCE TECHNIQUES
T. Vo-Dinh 1981 15 p refs Presented at the Instrument Soc. of America Symp., St. Louis, 23 Mar. 1981
(Contract W-7405-eng-26)
(CONF-810346-1) Avail: NTIS HC A02/MF A01

A report is presented on recent developments in luminescence analysis of atmospheric samples using two simple luminescence methods, the synchronous excitation and the room temperature phosphorescence (RPT) techniques. Samples extracted from high volume samplers are analyzed for their content of certain polynuclear aromatic (PNA) compounds using these two spectroscopic methods. The RPT technique also provides a novel approach for direct detection of PNA vapors collected on filter paper. DOE

N81-28620# Battelle Columbus Labs., Ohio.
CONSTRUCTION MATERIALS FOR WET SCRUBBERS, VOLUME 2 Final Report
H. S. Rosenberg, H. H. Krause, L. J. Nowacki, C. W. Kistler, J. A. Beavers, R. B. Engdahl, R. J. Dick, and J. H. Oxley Mar. 1981 304 p Sponsored by EPRI
(EPRI Proj. 982-14)
(EPRI-CS-1736-Vol-2) Avail: NTIS HC A14/MF A01

A comprehensive documentation and analysis of utility experience with materials of construction in full-scale lime and limestone wet fluidized gas desulfurization (FGD) systems is presented. Information of field performance of construction materials was collected by site visits, by telephone and letter contacts with FGD system operators and equipment vendors and by literature searches. Information was collected on: prescrubbers, absorbers, spray nozzles, mist eliminators, reheaters, fans, ducts, expansion joints, dampers, stacks, storage silos, bal

mills and slakers, pumps, piping and valves, tanks and thickness, agitators and rakes, vacuum filters and centrifuges, and pond linings. Materials documentation and analysis includes successes, failures, and relative costs of various materials. DOE

N81-28621# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
REPORT OF AD HOC TASK FORCE ON INDOOR AIR POLLUTION
C. S. Dudney, ed. and P. J. Walsh, ed. Apr. 1981 245 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7679) Avail: NTIS HC A11/MF A01

The quality of air within a man made structure is likely to be affected by energy conserving modifications made on that structure. Information was reviewed on indoor air pollution and the potential impact on human health of energy conservation measures, primarily those to be applied in residences. Results indicate that indoor air pollution may significantly affect human health. It is concluded that: (1) the indoor environment is likely to include exposure to randon daughter nuclides, formaldehyde, carbon monoxide, nitrogen dioxide, respirable particulates, and asbestos, as well as other underfined pollutants; (2) indoor exposure may consititute 80 to 95% of the total exposure for some pollutants; (3) studies have not been done which provide a basis for an adequate assessment of indoor air quality; (4) some energy conservation measures reduce the rate of exchange between indoor and outdoor air; (5) reduced air exchange can lead to increased indoor levels of some pollutants; (6) increased indoor pollutant levels lead to increased exposure and increased risk of health impact; and (7) many federal agencies have an interest in various facets of indoor air pollution, but no agency has authority over the entire problem, and there has not been adequate coordination among the interested agencies. DOE

N81-28622# Greater Caribbean Energy and Environment Foundation, Inc., Key Biscayne, Fla.
GREATER CARIBBEAN ENERGY AND ENVIRONMENT FUTURE. AD HOC WORKING GROUP REPORT
Anitra Thorhaug, ed. 1980 20 p refs Presented at Key Biscayne, Fla., 26-28 Oct. 1980; sponsored in part by Florida International Univ.
(Contract FG-01-80EV-10454)
(DOE/EV-10454/T1) Avail: NTIS HC A02/MF A01

The process by which environmental assessments by tropical experts can be successfully integrated into energy decisions is by: international loan institutions requiring or strongly recommending excellent assessments; engineering awareness of total effects of energy projects; governmental environmental consciousness-raising with regard to natural resource value and potential inadvertent and unnecessary resource losses during energy development; and media participation. Research tasks for today and twenty years hence, needed research, demonstration and information dissemination projects to get knowledge about Caribbean energy-environment used, and recommendation are presented. DOE

N81-28623# Florida Univ., Gainesville. Dept. of Chemistry.
DEVELOPMENT OF LASER-EXCITED MOLECULAR LUMINESCENCE SPECTROMETRIC METHODS FOR POLYNUCLEAR ATOMATIC HYDROCARBONS IN ENVIRONMENTAL SAMPLES Progress Report, 1 Sep. 1979 - 1 Apr. 1980
J. D. Winefordner 1980 35 p
(Contract DE-AS05-78EV-06022)
(DOE/EV-06022/1) Avail: NTIS HC A03/MF A01

Fluorescence and phosphorescence of several PAH's were studied for use in chemical analysis. Data are given for lifetime, heavy atom effect, maxima, spectral slopes, limit of detection, and RSD. DOE

N81-28624# Texas Univ. at Arlington.
ENVIRONMENTAL EFFECTS OF IN SITU GASIFICATION OF TEXAS LIGNITE Final Report, Oct. 1978 - Mar. 1980
T. F. Edgar, M. J. Humenick, W. R. Kaiser, and R. J. Charbeneau Mar. 1981 161 p refs
(Grant EPA-R-806261)
(PB81-171654; EPA-600/7-81-035) Avail: NTIS HC A08/MF A01 CSCL 13B

A general survey of gasification emphasized: identification of location, quality and quantity of resources; assessment of applicable in-situ gasification technologies; determination of possible adverse air, water and land environmental impacts resulting from gasification; and evaluation of dispersion and mathematical models to predict pollutant transport is presented. An assessment of control technology for water pollutants is presented. GRA

N81-28625# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
US ENVIRONMENTAL PROTECTION AGENCY INTRA-AGENCY TASK FORCE REPORT ON AIR QUALITY INDICATORS
W. F. Hunt, Jr., G. Akland, W. Cox, T. Curran, N. Frank, S. Goranson, P. Ross, H. Sauls, and J. Suggs Feb. 1981 114 p refs
(PB81-177982; EPA-450/4-81-015) Avail: NTIS HC A06/MF A01 CSCL 13B

Standardized air quality indicators and statistical methodologies for presenting air quality status and trends in national publications are considered under four categories: data base, data analysis, data interpretation and data presentation. The position papers dealing with precision and accuracy data, detecting and removing outliers, area of coverage and representativeness, data completeness and historical continuity, statistical indicators and trend techniques, inference and conclusion, data presentation, and continuity of year to year reports are included. GRA

N81-28626 California Univ., Berkeley.
PREDICTION OF RELATIVE VAPOR RATIOS FOR BINARY MIXTURES APPLICABLE TO INDUSTRIAL HYGIENE Ph.D. Thesis
Edward Charles Bishop 1980 160 p
Avail: Univ. Microfilms Order No. 8112966

A theoretical model for predicting the relative vapor ratios produced by the evaporation of constant composition, nonideal, liquid solvent mixtures into a moving airstream is presented. This is a hybrid model consisting of a thermodynamic model to predict the equilibrium vapor mole fractions for nonideal (or ideal) liquids, and a mass transfer model to predict the dilution of the relative equilibrium concentrations to the breathing zone concentrations of concern to the industrial hygienist. The unique features of this model are the method of predicting the activity coefficient (a correction from ideal liquid behavior as expressed by Raoult's Law) using the UNIversal quasichemical Functional Activity Coefficient (UNIFAC) prediction model, and the elimination of all geometry specific mass transfer parameters resulting in the relative mass transfer of each component being proportional to its diffusivity to the one-half power. Dissert. Abstr.

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-28627 California Univ., Los Angeles.
ANISOTROPY IN THE UPPER MANTLE OF EURASIA Ph.D. Thesis
Amy Hueymei Liao 1981 191 p
Avail: Univ. Microfilms Order No. 8113870

Fundamental mode Rayleigh- and Love-wave phase velocities in the period range from 30 to 250 sec are to study anisotropy in the upper mantle of different tectonic provinces with the Eurasian continent. The phase-travel time data were obtained for a number of long paths that traverse the continent between the earthquakes and WWSSN stations around its perimeter. Several linear and nonlinear inversions are performed based on various parameterizations of the upper mantle of the regions and various combinations of data sets. The regionalization takes into account broad-scale information from a number of sources including plate tectonics. The results show that the upper mantle

of Eurasia can be either of shield-types or non-shield-types. The shields areas include the Siberian shield as well as the Tibetan plateau, both having high velocity material extending to great depth. The rest of the continent has a thin, high-velocity lid, overlying a low velocity channel of marked velocity contrast.
Dissert. Abstr.

N81-28628 California Univ., Berkeley.
SEISMIC VELOCITY STRUCTURE AND ASSOCIATED TECTONICS OF NORTHERN CALIFORNIA Ph.D. Thesis
Gerald Wayne Simila 1980 186 p
Avail: Univ. Microfilms Order No. 8113190

Crust and upper mantle velocity models were derived using observations from body and surface waves. Regionalized Rayleigh-wave group velocity dispersion curves were determined by a least-squares technique for six regionalized tectonic provinces, and linear inversion and Haskell-Thompson matrix techniques were used to derive shear-wave velocity structure. P-wave travel times were analyzed to determine P sub n velocity profiles and associated crustal thickness. In addition, teleseismic P-wave relative residuals were modeled for velocity variations in the upper mantle by a simple ray tracing technique. General seismicity characteristics and a selected set of fault-plane solutions were determined for the six provinces to infer the contemporary tectonics stress regime of northern California. Dissert. Abstr.

N81-28629 California Univ., Berkeley.
ROCKET OBSERVATIONS OF NATURAL AND ARTIFICIALLY STIMULATED PHENOMENA WITHIN A QUIET AURORAL ARC Ph.D. Thesis
Albert John Mallinckrodt, III 1980 121 p
Avail: Univ. Microfilms Order No. 8113125

An Aries sounding rocket measured particle fluxes, dc and ac electric fields and plasma density within and on the equatorward side of a quiet auroral arc. A striking anticorrelation between the cross-arc component of the electric field and the energy of the secondary peak in the electron differential particle flux was observed. A numerical procedure was developed to simulate auroral electrodynamics and shows the observed anticorrelation to be consistent with a model in which field-aligned sheet currents are negligible with respect to ionospheric height integrated currents. The electric field is then determined from the divergenceless flow of the ionospheric current system and the transverse conductivities which are in turn controlled by the precipitating electrons. In addition large amplitude high frequency plasma waves were observed within a plasma density enhancement artificially created by a barium shaped charge experiment included on the payload. Dissert. Abstr.

N81-28630 Wisconsin Univ. - Madison.
THE UTILITY OF SATELLITE DATA IN ESTIMATING THE ENERGY BUDGETS OF THE EARTH'S SURFACE Ph.D. Thesis
George Russell Diak 1980 108 p
Avail: Univ. Microfilms Order No. 8107023

Investigations of the terms of the energy balance equation of the surface are done using satellite and combination satellite-surface network observations. A model is developed for estimating the incident solar energy at the surface, under clear and cloudy conditions, using satellite visible channel brightness values. Net shortwave energy is derived from this incident energy and a satellite-observed surface albedo. The relationship of upwelling longwave radiation to the surface temperature and emissivity is examined. Remote temperature measurement errors to uncertainties in the surface emissivity are estimated. The non-radiative terms of the energy-balance equation are evaluated using an aerodynamic-energy balance scheme. Sensible heat is calculated from flux-profile theory using remotely sensed surface temperature, air temperature at shelter height and wind speed at anemometer height as boundary conditions in temperature and momentum.
Dissert. Abstr.

N81-28631 Colorado Univ. at Boulder.
COMPRESSIBLE CONVECTION IN A ROTATING SPHERICAL SHELL Ph.D. Thesis
Gary Andrew Glatzmaier 1980 197 p
Avail: Univ. Microfilms Order No. 8113962

Anelastic fluid equations are used to find solutions which help in understanding the role the large density variation present in the solar convection zone plays in the maintenance of solar differential rotation via the transport of angula momentum by global scale convection. The equations are derived by a formal expansion in powers of a small parameter which is a measure of the departure of the fluid from an adiabatic atmosphere or, equivalently, the Mach number. As a result, acoustic waves are filtered out. Dissert. Abstr.

N81-28632 Pittsburg Univ., Pa.
GRAVITATIONAL RADIATION IN ROBERTSON-WALKER SPACE-TIME Ph.D. Thesis
Janis M. Niedra 1980 90 p
Avail: Univ. Microfilms Order No. 8112627

Two major theories of gravitational radiation in the ideal fluid cosmological background are examined, for the purpose of discovering their relationship. The theory of radiative perturbation is shown to be a proper subset of the theory of radiative perturbations. In the case of positive background curvature, this subset consists of perturbations of odd spatial parity. One expects this subset to consist of odd-parity waves in at least the case of negative background curvature as well, because of the properties of the harmonics on the curved background spaces. A perturbation scheme is developed that includes both odd and even parity gravitational waves. A gauge invariant statement is formulated that sharpens the definition of the meaning of no perturbation of matter. Dissert. Abstr.

N81-28633 Texas Univ. at Dallas.
OBSERVATIONAL EVIDENCE FOR A BOUNDARY LAYER SOURCE OF DAYSIDE REGION 1 FIELD ALIGNED CURRENTS Ph.D. Thesis
Peter Francis Bythrow 1981 131 p
Avail: Univ. Microfilms Order No. 8113928

The magnetic field measurements from the Atmosphere Explorer C are used to examine the relations between field aligned currents (FAC), energetic particles, and plasma convection in the high latitude ionosphere. In general, magnetic field perturbations extend throughout the regions of gradients in the plasma convection, particularly equatorward of the plasma convection reversal. A study of 13 dayside polar passes shows that the Region I FACs are observed to span the convection reversal and extend an average 0.5 deg invariant latitude poleward the reversal. Region II currents are observed entirely on sunward convecting plasma. Simultaneous observations of low energy electron data (200 ev to 25 kev) indicate that the poleward limit of the Region I FACs is nearly coincident with the high latitude limit of 1 keV plasma sheet electrons. Dissert. Abstr.

N81-28634 Colorado Univ. at Boulder.
AN OBSERVATIONAL AND NUMERICAL STUDY OF THE ATMOSPHERIC BOUNDARY LAYER OVERLYING THE EAST ANTARCTIC ICE SHEET Ph.D. Thesis
William David Neff 1980 291 p
Avail: Univ. Microfilms Order No. 8113990

An observational and numerical study of the lowest few hundred meters of the atmosphere overlying the East Antarctic ice sheet is presented. Observations are interpreted and a second-order turbulence closure model is assessed and modified. The observations and modeling show that additive slope induced and synoptic pressure gradients produce a growing, nearly well mixed boundary layer. Opposing gradients reduce turbulent mixing and lead to intermittent turbulent layers and patches, the origin and evolution of which depend sensitively on initial conditions and accelerations due to horizontal variations in temperature. From model calculations, inertial oscillations outside of the boundary layer are found to modulate the shear and lead either to the generation or suppression of turbulence, depending on the phase of the oscillation relative to the sign of the mean shear. In agreement with observations, the model shows that elevated layers are more likely to occur when the slope induced force opposes that of the pressure gradient force. Dissert. Abstr.

N81-28635 Princeton Univ., N. J.
NUMERICAL STUDIES OF WAVE-MEAN FLOW INTERACTION IN THE STRATOSPHERE, MESOSPHERE AND LOWER THERMOSPHERE Ph.D. Thesis
Kevin Peardon Hamilton 1981 378 p

Avail: Univ. Microfilms Order No. 8114116

Two problems in the general circulation of the upper atmosphere are investigated. The effects of the solar diurnal tide on the zonally averaged circulation are considered. A zonal-mean model of the circulation between 20 and 120 km was constructed. In this model the effects of eddies were parameterized with a Rayleigh friction on the zonal mean zonal wind. The Rayleigh friction coefficient was adjusted so that a realistic simulation of the annual cycle of the mean flow results when the model is forced with seasonally varying radiation. Calculations of the tidally-induced mean flow accelerations in the Martian atmosphere were also performed. The second problem considered is the role of wavemean flow interaction in the quasi-biennial oscillation (QBO) of the tropical lower stratosphere. A slightly generalized version of the Holton-Lindzen one dimensional model was constructed and extensively tested. A two dimensional QBO model employing a two scale analysis to separate the latitude and height dependence of the wave fields (but allowing the inclusion of horizontal shear) was constructed. Results are discussed for each model. DOE

N81-28636 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC CHEMICAL AND THERMAL RESPONSE TO LONG TERM VARIABILITY IN SOLAR UV IRRADIANCE
G. Brasseur and P. C. Simon 1980 86 p refs Submitted for publication
(Aeronomica-Acta-A-213-1980) Avail: Issuing Activity

The chemical response of the stratosphere to possible long term variability in solar ultraviolet irradiance is analyzed taking into account the thermal feedback effect on the reaction rates. Numerical values of ultraviolet and visible irradiation fluxes are given for aeronomic modeling purposes and a possible variability related to the 11 year solar cycle is suggested. This variability is introduced on a stratospheric two dimensional model which simulates the zonally averaged distribution of the chemical species related to the oxygen, hydrogen, nitrogen and chlorine families. The results lead to a total ozone variation on the order of 3% from minimum to maximum solar activity, with a maximum of about 10% in the upper stratosphere. At these heights, the calculated temperature change is close to 2 to 4 deg. The N2O concentration appears to be one of the most sensitive to long term solar variability and monitoring of this constituent is proposed to provide information on solar variability in the ultraviolet.
Author (ESA)

N81-28637 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ATOMIC OXYGEN DETERMINATION FROM A NITRIC OXIDE POINT RELEASE IN THE EQUATORIAL LOWER ATMOSPHERE
E. vanHemelrijck et al 1980 35 p refs Submitted for publication
(Aeronomica-Acta-A-226-1980) Avail: Issuing Activity

Atomic oxygen density values at 80 to 105 km altitude in the equatorial region, obtained by analyzing the chemiluminescence of nitric oxide point releases from three Centaure II-C rockets, are discussed. The light emission produced by the NO-O chemiluminous recombination was sufficiently high to render the artificial clouds observable only by ground based instruments. The difficulties associated with this kind of experiment were avoided by using a technique for ejecting the NO gas into the backward direction of the flight. Below 90 km the derived atomic oxygen densities are in relatively good agreement with those reported elsewhere. At approximately 105 km, the measured value is two times higher than the n(O) density obtained by averaging a set of data from a great number of other flights, but coincides rather well with a set of recent measurements.
Author (ESA)

N81-28638 Institut d'Aeronomie Spatiale de Belgique, Brussels.
EFFECTS OF SOLAR VARIATIONS ON THE UPPER ATMOSPHERE
G. Kockarts 1981 47 p refs Presented at 14th ESLAB Symp., Scheveningen, Netherlands, 16-19 Sep. 1980 Submitted for publication
(Aeronomica-Acta-A-229-1981) Avail: Issuing Activity

Several presently available semi-empirical models of the terrestrial upper atmosphere which are presently available are discussed. These models take into account solar activity effets by using the solar decimetric flux as an index. Such a procedure is a consequence of the lack of continuous determinations of the solar spectrum directly responsible for the physical structure of the upper atmosphere. Variations of the thermopause temperature are discussed. Using five sets of solar irradiances measured in the ultraviolet and in the extreme ultraviolet, the penetration of solar radiation is analyzed as a function of solar activity. Several examples of absorption profiles and ion production rates are discussed for variable conditions. Various energetic effects are also described. All computations are made for physical conditions above Scheveningen (52.08 deg N). Author (ESA)

N81-28639*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
MIDDLE ATMOSPHERE PROJECT: A RADIATIVE HEATING AND COOLING ALGORITHM FOR A NUMERICAL MODEL OF THE LARGE SCALE STRATOSPHERIC CIRCULATION
William M. Wehrbein and Conway B. Leovy Jul. 1981 67 p refs
(Grant NAG2-66)
(NASA-CR-164646; Rept-2) Avail: NTIS HC A04/MF A01 CSCL 04A

A Curtis matrix is used to compute cooling by the 15 micron and 10 micron bands of carbon dioxide. Escape of radiation to space and exchange the lower boundary are used for the 9.6 micron band of ozone. Voigt line shape, vibrational relaxation, line overlap, and the temperature dependence of line strength distributions and transmission functions are incorporated into the Curtis matrices. The distributions of the atmospheric constituents included in the algorithm, and the method used to compute the Curtis matrices are discussed as well as cooling or heating by the 9.6 micron band of ozone. The FORTRAN programs and subroutines that were developed are described and listed. A.R.H.

N81-28640# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF THE IONOSPHERIC F SUB OF SUB 2 CHARACTERISTICS AT CACHOEIRA PAULISTA AND TUCHMAN, IN THE SOUTH AMERICAN REGION
R. P. Kane and E. R. Paula May 1981 7 p refs Presented at the 33d Meeting of SBPC, Salvador, 8-15 Jul. 1981 Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-2056-RPE/302) Avail: NTIS HC A02/MF A01

The monthly median characteristics were compared for 4 selected months in 4 different seasons (March, June, September and December, 1978). Considerable differences were observed. The implication of this for the fountain effect at the two locations was examined. T.M.

N81-28641# Air Force Geophysics Lab., Hanscom AFB, Mass.
STRATOSPHERIC CRYOGENIC INTERFEROMETER BALLOON EXPERIMENT (SCRIBE) Instrumentation papers
G. A. Vanasse 20 Feb. 1981 28 p refs
(AF Proj. 2310)
(AD-A100218; AFGL-TR-81-0048; AFGL-IP-300) Avail: NTIS HC A03/MF A01 CSCL 17/8

A 0.1/cm resolution LiN2 cooled cat's eye interferometer was flown on 8 October 1980 from Holloman AFB. A description of the instrument is given as well as its performance with sample interferograms and spectra shown. It is demonstrated that the interferometer is capable of yielding resolutions approx. 0.1/cm while in flight and cooled to 77 K. A spectrum showing the resolution capability of the instrument is presented, and analysis of the data is in progress. No data were obtained above 6 km due either to loss of laser fringe amplitude or to electronic component failure. Author (GRA)

N81-28642# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
SIMULTANEOUS OBSERVATIONS OF AURORAL ZONE ELECTRODYNAMICS BY TWO SATELLITES: EVIDENCE FOR HEIGHT VARIATIONS IN THE TOPSIDE IONOSPHERE Scientific Interim Report
Frederick J. Rich (Regis College), Cynthia A. Cattell (California Univ.), Michael C. Kelley (Cornell Univ.), and William J. Burke 10 Nov. 1980 36 p refs

(AF Proj. 2311)
(AD-A100237; AFGL-TR-80-0342; AFGL-ERP-719) Avail: NTIS HC A03/MF A01 CSCL 04/1

The S3-2 and S3-3 satellites were launched with identical orbit inclinations and with apogees of 1500 and 8000 km respectively. By comparing a few cases when the satellites were crossing the auroral zone at approximately the same universal time and location, altitude variations in the electrodynamics of the auroral zones can be separated from universal and local time variations. Such comparisons show that there are times when the field aligned current per unit of flux in the auroral zone measured by magnetic field deflections at the two satellites is the same at both altitudes. There are also times when the field aligned current per unit of flux is larger at high altitudes then at low altitudes. This requires convection electric field at the two altitudes show that the electric field does not always map as though field lines were were equipotentials. In addition, intense, small scale (0.1 deg) electric fields perpendicular to the magnetic field observed at high altitudes are usually not seen in simultaneous low altitude observations. GRA

N81-28643# Air Force Geophysics Lab., Hanscom AFB, Mass. Terrestrial Sciences Div.
THE AIR FORCE GEOPHYSICS LABORATORY STANDALONE DATA ACQUISITION SYSTEM: A FUNCTIONAL DESCRIPTION Scientific Interim Report
Peter G. vonGlahn 9 Oct. 1980 259 p refs
(AF Proj. 7600)
(AD-A100253; AFGL-TR-80-0317; AFGL-IP-293) Avail: NTIS HC A12/MF A01 CSCL 09/3

The Standalone Data Acquisition System (SDAS) is a portable digital data recording system for geophysical field data collection. This report describes the SDAS, giving special emphasis to the SDAS signal conditioning subsystem, which uses custom-designed active filter modules for signal filtering and amplifications. Detailed descriptions of the active filters, including design equations and software, are provided. This subsystem, together with software for its configuration and performance verification, provides an improved capability for analog signal conditioning. This report also provides a functional description of the SDAS. It documents the system hardware and such software as is needed for system configuration and checkout. Each subsystem in the SDAS is described via functional descriptions and such diagrams and schematics as are necessary to understand subsystem functioning. Detailed schematics, parts lists, software listings, and subsystem specifications are covered in appendices. GRA

N81-28644# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
VERTICAL TRANSPORT BY SMALL SCALE STRATOSPHERIC TURBULENCE: A CRITICAL REVIEW
Edmond M. Dewan 17 Feb. 1981 34 p refs
(AF Proj. 6687)
(AD-A100211; AFGL-TR-81-0051; AFGL-ERP-729) Avail: NTIS HC A03/MF A01 CSCL 04/1

This paper reviews the estimates to date of the vertical 'effective diffusion coefficient' for stratospheric small scale turbulence transport, KB. These estimates range (in order of magnitude) from 1.0 sq. meter/s to 0.01 sq. meter/s, that is to say from a value which would make turbulence a dominant factor in stratospheric transport to a value which would make it totally insignificant. Such a large range implies much ignorance in this subject. The various techniques are closely examined and the unanswered experimental questions are exhibited. The conclusion is reached that more experimental work needs to be done before one has a reliable estimate for KB. Author (GRA)

N81-28645# Naval Postgraduate School, Monterey, Calif.
DATA ACQUISITION SYSTEM FOR USE IN THE STUDY OF GEOMAGNETIC VARIATIONS M.S. Thesis
Hugh H. Thomas Dec. 1980 100 p refs
(AD-A100156) Avail: NTIS HC A05/MF A01 CSCL 09/2

The study of the variations in the geomagnetic field requires a small, low power digital acquisition system. This thesis describes the design of a digital data acquisition system for such use. The design uses the complementary metal-oxide-semiconductor (CMOS) version of the INTEL 8048 single chip microcomputer and a high density data recorder. The microcomputers do not take data internally, instead they route data over a separate data bus. Two intermediate data memories are used; alternating between being written onto by the acquisition circuit and being read from for writing to the data recorder. Author (GRA)

N81-28646# Naval Research Lab., Washington, D. C.
THE STP/S3-4 SATELLITE EXPERIMENT: HIGH LATITUDE LARGE SCALE DENSITY IRREGULARITIES Interim Report
P. Rodriguez, M. Singh, E. P. Szuszczewicz, D. N. Walker, and J. C. Holmes 26 May 1981 27 p refs Sponsored in cooperation with Air Force Space Test Program, Naval Space Systems Activity and ONR
(RR0330244)
(AD-A100363; NRL-MR-4514) Avail: NTIS HC A03/MF A01 CSCL 04/1

Large scale density irregularities in the nighttime auroral zone F-region are routinely detected by a pair of pulsed plasma probes on the s3-4 satellite. The absolute density variations can be as large as an order of magnitude and in the case of a quiet diffuse aurora, the irregularities appear to be consistent with the sheet-like structures that have been postulated to explain high latitude scintillation enhancements. In a more dynamic situation, which we believe to be a surging aurora, the density variations may be associated with a density gradient and/or current-driven plasma instability. We have made preliminary analyses of the density fluctuations and FFT power spectra for evidence of characteristic scale sizes and power law dependence. Scale sizes from 10-300 km are clearly evident in the irregularities; power law fits to the spectra have spectral indices in the range -1.5 to -1.7. For the diffuse aurora our results suggest support for a recent numerical study of the nonlinear evolution of the current convective instability. Author (GRA)

N81-28647# Naval Research Lab., Washington, D. C.
POLARIMETRY STUDIES OF IONOSPHERIC MODIFICATION BY ROCKET BOOSTERS Final Report
M. H. Reilly, L. O. Harnish, and J. M. Goodman 27 May 1981 89 p refs
(RR0330244)
(AD-A100371; NRL-MR-4517) Avail: NTIS HC A05/MF A01 CSCL 04/1

High altitude releases of certain molecules in booster rocket exhausts are known to deplete electron concentration in the ionosphere dramatically. These effects are exhibited in recent Faraday rotation measurement for the HEAO-C launch from Cape Kennedy on September 20, 1979 and the NOAA-B launch from Vandenberg on May 29, 1980, in which total electron content drop-out responses to the booster rockets are evident. The polarimetry experiments and data for these nocturnal launches are presented, discussed, and analyzed to obtain time profiles of total electron content (TEC) associated with three different satellite-to-receiver raypaths. Calculations of the booster rocket effect are carried out in detail for the HEAO-C case in an attempt to theoretically simulate the experimental results for the early-time TEC depletion effect from the booster rocket. The calculational model includes a full, three dimensional integration of the rocket exhaust effect, in which rocket exhaust expansion is treated as thermalized, mutual diffusion in the non-uniform ambient background atmosphere. Results are discussed, and future directions are indicated. Author (GRA)

N81-28648# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF ROCKET TRIGGERED LIGHTNING FOR RESEARCH AND DEVELOPMENT M.S. Thesis
Jack R. Lippert May 1981 71 p refs
(AD-A100548; AFIT/GE/EE/81J-5) Avail: NTIS HC A04/MF A01 CSCL 04/1

The feasibility of using rocket-triggered lightning as a research and development tool for testing hardware is investigated. Previous experimental work in the area is examined and used as the foundation for the experiments in this thesis to establish the significant factors of a successful lightning-triggering station. Using a point charge model, computer simulations were performed to

determine the most probable locations of the charge centers associated with the triggered discharge. Five electric field records obtained from field mills were used to perform this simulation. A full scale test technique configuration is proposed for subjecting representative Air Force subsystems and components to the lightning threat. A conclusion is drawn that such a system is feasible at Mt. Baldy, New Mexico with minor augmentations of the existing facilities of the Langmuir laboratory. Author (GRA)

N81-28649# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.

SUMMARY OF POTASSIUM/ARGON AGE DATING, 1980

Stanley H. Evans, Jr. and F. H. Brown Nov. 1980 27 p refs (Contract DE-AC07-79ID-12079)

(DOE/ID-12079/23) Avail: NTIS HC A03/MF A01

A significant improvement in efficiency of the K-Ar laboratory was brought about by completion of a second extraction line. Two extractions can now be done routinely each day and the Ar spike ratios of the new table will permit dating of much younger samples than previously. Extensive K-Ar dating of samples from the Mineral Mountains shows intervals of silicic volcanism at 0.5, 0.8, and 7.5 m.y. K-Ar dating of plutonic units does not present a consistent picture, however. Plutonic events 35 to 40 m.y., 29 m.y. and 19 to 21 m.y. ago are suggested but interpretation must be considered preliminary. Joint programs with the US Geological Survey now underway to study the Rb-Sr and U-Pb systematics of the Mineral Mountains pluton should aid in unravelling its history. Dating of basalts from the Cove Creek Domes/Twin Peaks area, Utah. aided in delineating the timing of basaltic volcanism. This adds to the already extensive data on the chronology of volcanic activity in the area. DOE

N81-28650# Central Research Inst. for Physics, Budapest (Hungary).

COMPARISON OF ION TEMPERATURE AND ION DENSITY MEASURED DURING GEOMAGNETICALLY VERY QUIET CONDITIONS ON BOARD THE GEOPHYSICAL ROCKET VERTICAL-6 WITH THE INTERNATIONAL REFERENCE IONOSPHERE

P. Bencze (Hungarian Academy of Sciences, Sopron), K. Novacs (Hungarian Academy of Sciences, Sopron), I. Apathy, I. Szemerey, V. Afonin (Academy of Sciences (USSR), Moscow), V. Bezrukih (Academy of Sciences (USSR), Moscow), and N. Shutte (Academy of Sciences (USSR), Moscow) May 1980 5 p refs Presented at the URSI/COSPAR Workshop on Experience and Proposed Improvements of the Intern. Reference Ionosphere/IRI, Budapest, 11-13 Jun. 1980

(KFKI-1980-30; HU-ISSN-0368-5330; ISBN-963-371-660-8) Avail: NTIS (US Sales Only)HC A02/MF A01; DOE Depository Libraries

Ion temperature and ion density were measured during the flight of the geophysical rocket Vertical-6, by means of a group of five retarding potential analyzers looking into different directions of space. The measurements were carried out in a geomagnetically quiet period to a height pf 1500 km. The results show that both the ion temperature and the ion density are lower than the values predicted by the Reference Ionosphere, the difference is decreasing with increasing altitude. DOE

N81-28651# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.

COMPLEX INVESTIGATION OF THE BASIC PARAMETERS OF THE UPPER ATMOSPHERE AT THE TIME OF THE FLIGHT OF THE GEOPHYSICAL ROCKET VERTICAL-6

I. Apathy, I. Szemerey, P. Bencze, K. Kovacs, V. Afonin (Academy of Sciences (USSR), Moscow), V. Bezrukih (Academy of Sciences (USSR), Moscow), K. Gringauz, and Z. Shutte May 1980 7 p refs Presented at the COSPAR Session ISC C, Representation of Energy Sources in the Earth's Upper Atmosphere and Ionosphere, Budapest, 9-14 Jun. 1980

(KFKI-1980-31) Avail: NTIS (US Sales Only)HC A02/MF A01; DOE Depository Libraries

Ion temperature and ion density, measured on October 29, 1977 during the flight of the geophysical rocket 'Vertical-6' by means of five retarding potential analyzers looking into different directions of space, are analyzed. The solar EUV fluxes determined in five wave length bands with a photoelectron analyzer are also given. Using the ion composition and electron temperature, measured simultaneously, it is shown that the average variation of ion temperature with altitude is in agreement with the heating of the ion gas by the ambient electrons. The observed anomalous variation of ion temperature between 700 and 900 km and the measured ion concentration could be explained, if the charge exchange reactions H() reversible O() and diffusion are also taken into consideration. DOE

N81-28652# Los Alamos Scientific Lab., N. Mex.

COMPLETE BOUGUER GRAVITY ANOMALY MAP OF THE SOCORRO 10 X 20 QUADRANGLE, NEW MEXICO

M. E. Ander Mar. 1981 24 p

(Contract W-7405-eng-36)

(LA-8679-MAP) Avail: NTIS HC A02/MF A01

A Bouguer gravity anomaly map with contour interval of 5 mgal is presented. Also included is a map of the locations of gravity stations in the Socorro 10 x 20 quadrangle, New Mexico. DOE

N81-28653# Cincinnati Univ., Ohio. Lab. of Sedimentology.

SEDIMENTOLOGY OF GAS-BEARING DEVONIAN SHALES OF THE APPALACHIAN BASIN

Paul Edwin Potter, J. Barry Maynard, and Wayne A. Pryor Jan. 1981 46 p refs

(DOE/METC-114) Avail: NTIS HC A03/MF A01

Sedimentology of the Devonian shales and its relationship to gas, oil, and uranium are reported. Information about the gas bearing Devonian shales of the Appalachian Basin is organized in the following sections: paleogeography and basin analysis; lithology and internal stratigraphy; paleontology; mineralogy, petrology, and chemistry; and gas oil, and uranimum. E.A.K.

N81-28654# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SIMPLIFIED CLEAR SKY MODEL FOR DIRECT AND DIFFUSE INSOLATION HORIZONTAL SURFACES

Richard E. Bird and Roland L. Hulstrom Feb. 1981 46 p refs (Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-642-761) Avail: NTIS HC A03/MF A01

A detailed comparison was made between five simple broadband models for clear sky global insolation. Compared models were those of Atwater and Ball, Davies and Hay, Watt, Hoyt, and Lacis and Hansen. A sixth simple model, called the Bird model, has been formulated by using parts of these five models and by comparison with the results from three rigorous radiative transfer codes. All of the simple models provide results that agree within 10% with the three rigorous codes when the Sun is in the zenith position. The Bird and Hoyt models agree within 3% with each other and with the results of the rigorous codes. However, the Bird model is easier to implement and has broader application than the Hoyt model. DOE

N81-28655# Yale Univ., New Haven, Conn.

SEASONAL VARIATIONS IN LIGHT SCATTERING IN THE NEW YORK REGION

Brian P. Leaderer, Roger L. Tanner (Brookhaven National Lab.), Paul J. Lioy (New York Univ. Medical Center), and Jan A. J. Stolwijk 1980 40 p refs Presented at Symp. on Plumes and Visibility, Grand Canyon, Ariz., 10 Nov. 1980 Submitted for publication Sponsored in part by NIH

(Contract DE-AC02-76CH-00016)

(BNL-29271; CONF-801114-10) Avail: NTIS HC A03/MF A01

Light scattering data collected during two periods of intensive sampling in New York City (one during summer months and one during winter months) are discussed and analyzed for diurnal patterns, their relationship to pollutant emission sources, meteorological parameters, and the size distribution and chemical composition of the ambient aerosol. Winter levels of light scattering observed in New York City, while approximately 50 percent lower than summer levels, were much less dependent on wind direction and closely related to pollutant emissions from local sources. This suggests that locally generated aerosol dominates light scattering in the winter. Variance in dry particulate light scattering was found to principally account for light extinction variance (calculated from airport visibility observations) in summer and winter. Sulfate aerosol was strongly correlated with light scattering during both summer and winter periods. DOE

N81-28656# Los Alamos Scientific Lab., N. Mex.
IONOSPHERIC MODIFICATION BY HIGH-POWER RADIO WAVES
Lewis M. Duncan Apr. 1981 11 p refs Presented at the Ionospheric Effects Symp., Alexandria, Va., 14 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-81-870; CONF-810421-2) Avail: NTIS HC A02/MF A01

The physics of ionospheric modification by high power radio waves is reviewed in the context of out current theoretical understanding disturbance generation mechanisms are qualitatively described. In addition, results of recent experiments are summarized in which ionospheric irregularities, are generated and their evolution and decay processes investigated in detail. The effects and potential controlled applications of these HF ionospheric modifications for various RF systems studies are discussed. The C3I scientific community provides an important motivation for these ionospheric modification studies, their increased interaction and active participation in experimental design and interpretation are encouraged. DOE

N81-28657# Los Alamos Scientific Lab., N. Mex.
REMOTE CHARACTERIZATION OF TIGHT GAS FORMATIONS WITH A NEW NMR LOGGING TOOL
J. A. Jackson, J. A. Brown, and T. R. Crawford 1981 18 p refs Presented at the Joint SPE/DOE Symp. on Low Permeability Gas Reservoirs, Denver, 27-29 May 1981
(Contract W-7405-eng-36)
(LA-UR-81-735; CONF-810518-4) Avail: NTIS HC A02/MF A01

A new nuclear magnetic resonance logging technique was developed. The tool has operating and measurement advantages in tight western gas sand formations over existing nuclear magnetic logging tools. The advantages are: elimination of the need to condition borehole fluids prior to logging a hole; higher sensitivity per unit sample volume; shorter instrumental dead time; and potential for greater formation penetration. The new technique has been laboratory tested in tool geometry. DOE

N81-28658# California Univ., Livermore. Lawrence Livermore Lab.
CHEMICAL, PHYSICAL, AND MINERALOGICAL CHARACTERIZATION OF FIFTEEN SANDSTONES FOR RADIONUCLIDE SORPTION STUDIES
S. Shultz-McKinley, Janet Garrison, Susan MacLean, and David G. Coles 21 Apr. 1981 61 p refs
(Contract W-7405-eng-48)
(UCID-19034) Avail: NTIS HC A04/MF A01

Samples from fifteen different sandstone formations representing a wide variation in quartz content and secondary alteration products were studied to determine their mineralogical, physical and chemical characteristics. Techniques used included X-ray diffraction, optical petrography, surface area, particle size distribution, scanning electron microscopy, and cation exchange capacity. The data obtained will be needed to determine radionuclide sorption coefficients as a function of varying mineral composition and other rock characteristics. DOE

N81-28659# Sandia Labs., Albuquerque, N. Mex. Seabed Programs Div.
GEOLOGIC FLOW CHARACTERIZATION USING TRACER TECHNIQUES
Robert D. Klett, Craig E. Tyner, and Eugene S. Hertel, Jr. (Dikewood Corp., Albuquerque, N. Mex.) Apr. 1981 84 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0454) Avail: NTIS HC A05/MF A01

A tracer flow test system was developed for in situ characterization of geologic formations. Two sets of test equipment are described: one portable and one for testing in deep formations. Equations are derived for in situ detector calibration, raw data reduction, and flow logging. Data analysis techniques are presented for computing porosity and permeability in unconfined isotropic media, and porosity, permeability and fracture characteristics in media with confined or unconfined two dimensional flow. The effects of tracer pulse spreading due to divergence, dispersion, and porous formations are also included. DOE

N81-28660# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SOUNDING ROCKET PROGRAM MAGNETOSPHERE: SUPRATHERMAL PARTICLE EXPERIMENTS TL7 AND KL7 Final Report
Klaus Wilhelm, Karl-Heinz Saeger, Christian Becker, Rudolf Schmidt and Wolfgang Engelhardt Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 41 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-46; ISSN-0170-1339) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,60

The scientific objectives of the suprathermal particle experiments TL7 and KL7, conducted in the framework of the magnetospheric sounding rocket projects 'Substorm phenomena' and 'Porcupine', are discussed. The source, distribution and variation of the magnetosphere electric field along with the particle distribution and wave field as well as their mutual effect are considered. The experiment design, instrumentation, and implementation are described in detail. A cylindrical plate electrostatic alanyzer was used. Also presented are the geophysical launch conditions, principles of the data analysis and selected results obtained. Of special interest are data on auroral particle acceleration. Author (ESA)

N81-28661# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
COMPILATION OF IONLAB RIOMETER DATA FOR THE PERIOD 16 TO 30 JUNE 1979
Peter Stauning and Bjarne Christensen Lyngby, Denmark Tech. Univ. of Denmark Feb. 1980 46 p
(IONLAB-R-60) Avail: NTIS HC A03/MF A01

Absorption data obtained from ionlab riometers located at a net of observatories in Greenland, Iceland, Faroe Islands and in Norway are presented. During the period covered, a number of balloon and space experiments were conducted for studies of the energetic particle precipitation into the auroral zone and polar cap atmospheres. The energetic particle precipitation is shown to be responsible for most of the absorption events diagrammed. The auroral and polar absorption events as observed from the presented riometer net are relatively weak and featureless. The riometer observations are presented in the form of 8 diagrams with 2 days of absorption data each, followed by 30 diagrams with 12 hours of absorption data each through the period. Station locations are given, and instruments are described.
Author (ESA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-28662 British Library Lending Div., Boston Spa (England).
DATA ON THE STRUCTURE AND VARIABILITY OF CLIMATE, AIR TEMPERATURE AT SEA LEVEL, NORTHERN HEMISPHERE
G. Spence and E. Ya. Rankova 1 Jul. 1980 23 p refs Transl. into ENGLISH of Vses. Nauch.-Issled. Inst. Gidromet. Inf.-Mirov. Tsent. Danny. (Obninsk), 1979
(BLL-Trans-1471-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

The empirical statistics of the field of air temperature at sea level in the Northern Hemisphere from 1891 to 1976 are discussed. These statistics are characteristic of the structure and variability of the climate, as observed. Data are presented relating to the geographical distribution of means; standard deviations and parameters of trends; annual variation and zonal variations; and also to the secular variation of the most important empirico-statistical characteristics of the temperature field; its gradients and anomalies. Presented graphically and in numerical form, the data may be widely applied for practical and research purposes. A.R.H.

N81-28663 British Library Lending Div., Boston Spa (England).
THE DISTRIBUTION OF THE PREVAILING FORMS OF

CLOUD COVER IN THE EXTRA-TROPICAL LATITUDES OF THE NORTHERN HEMISPHERE
V. D. Shapovalova 1 Jul. 1980 12 p refs Transl. into ENGLISH from Glav. Geof. Obs. T. Vyp. (Leningrad), v. 425, 1979 p 51-57
(BLL-Trans-1474-(9022.549)) Avail: British Library Lending Div., Boston Spa, England

The methodology for transforming visual information on cloud cover into numerical form was reviewed. The absolute frequency of clouds of a given form was chosen as the major climatic characteristic. The frequency of a given form was computed for equal sized areas and related to the mean for each area. Maps were constructed based on these frequencies. T.M.

N81-28664 British Library Lending Div., Boston Spa (England).
ESTIMATING THE 12-HOUR AMOUNT OF PRECIPITATION FROM RADAR NETWORK DATA
Zh. D. Alibegova et al 16 Jan. 1980 11 p refs Transl. into ENGLISH from Glav. Geof. Obs. T. Vyp. (Leningrad), v. 411, 1978 p 32-39
(BLL-Trans-1448-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A method of applying operational radar information to estimate the precipitation in a cell of 30 x 30 sq km at a range of 90-120km from the radar installation, using the existing program of observations at synoptic hours and the established system of storm warnings, is presented. Functional statistical relationships between precipitation characteristics are given. Analysis of the precipitation characteristics indicated that the formation mechanisms of heavy and very heavy precipitation are probably similar to one another under different physico-geographical conditions. T.M.

N81-28665 Colorado Univ. at Boulder.
A MODEL OF THE LIGHTNING RETURN STROKE Ph.D. Thesis
Robert Lee Gardner 1980 182 p
Avail: Univ. Microfilms Order No. 8113960

The electromagnetic fields radiated by a lightning return stroke provide a means of learning about the return stroke current by remote sensing techniques. Two models needed to establish the correspondence between the current and fields are analyzed. One of the models allows predictions to be made of electromagnetic fields from a complex return stroke current model in a realistic Earth ionosphere environment. Dissert. Abstr.

N81-28666 Washington Univ., Seattle.
A COMPARISON OF THE OBSERVED EXTRATROPICAL NORTHERN HEMISPHERE SUMMERTIME AND WINTERTIME CIRCULATIONS Ph.D. Thesis
Glenn Hazen White 1981 137 p
Avail: Univ. Microfilms Order No. 8113480

The three dimensional structure of the extratropical Northern Hemisphere (north of 20 N) summertime general circulation is documented. Two distinct regimes of standing waves quite unlike the wintertime standing waves appear a subtropical regime which is clearly a monsoonal response to thermal forcing and a high lattitude regime in which the standing waves are smaller scale and much weaker than in winter and are equilivalent barotropic in structure with almost no vertical tilt. While the transient eddies shift northward from their wintertime location and are weaker in summer, their properties and relation to the mean flow are much the same as in winter. In both seasons, the regions of strongest transient activity generally coincide with the regions where the height scale of the most unstable baraclinic wave is large compared to the atmospheric scale height, except where strongly sloping terrain inhibits baraclinic instability. Dissert. Abstr.

N81-28667*# Chicago Univ., Ill.
PRECIPITATION GROWTH IN CONVECTIVE CLOUDS Final Technical Report, 1 Aug. 1979 - 31 Jul. 1981
R. C. Srivastava 31 Jul. 1981 52 p refs
(Grant NsG-5402; NSF ATM-80-16150)
(NASA-CR-164640) Avail: NTIS HC A04/MF A01 CSCL 04B

Analytical solutions to the equations of both the growth and motion of hailstones in updrafts and of cloud water contents which vary linearly with height were used to investigate hail growth in a model cloud. A strong correlation was found between the hail embyro starting position and its trajectory and final size. A simple model of the evolution of particle size distribution by coalescence and spontaneous and binary disintegrations was formulated. Solutions for the mean mass of the distribution and the equilibrium size distribution were obtained for the case of constant collection kernel and disintegration parameters. Azimuthal scans of Doppler velocity at a number of elevation angles were used to calculate high resolution vertical profiles of particle speed and horizontal divergence (the vertical air velocity) in a region of widespread precipitation trailing a mid-latitude squall line. A.R.H.

N81-28668# World Meteorological Organization, Geneva (Switzerland). Commission for Marine Meteorology.
REPORTS ON MARINE SCIENCE AFFAIRS. REPORT 14: SATELLITE DATA REQUIREMENTS FOR MARINE METEOROLOGICAL SERVICES
G. D. Hamilton 1980 53 p refs
(WMO-548; ISBN-92-63-10548-0; Rept-14) Avail: NTIS MF A01; print copy available from WMO, Geneva

The applications of satellite data in marine meteorology are reviewed, and the specific requirements for quantitative data gathered by satellite are discussed. The analysis of satellite derived parameters includes surface winds, sea and swell, surface visibility, ice accretion, precipitation, cloud cover, air temperature, humidity, sea surface temperature, surface currents, atmospheric pressure, surf and breakers, storm surge, and sea ice. The availability and access to satellite data for the various marine user groups is examined. A tabular summary of satellites of utility to marine meteorology, their sensors, and observable parameters is provided. Author (ESA)

N81-28669# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
AN AUTOMATED REAL-TIME STORM ANALYSIS AND STORM TRACKING PROGRAM (WEATRK) Final Report
Carlton L. Bjerkaas and Douglas E. Forsyth 1 Oct. 1980 114 p refs
(AF Proj. 6670)
(AD-A100236; AFGL-TR-80-0316; AFGL-ERP-715) Avail: NTIS HC A06/MF A01 CSCL 04/2

The evolution of the WEATRK system is described from the original software obtained under contract in 1977, to the present software configuration. The various portions of the software are discussed with emphasis on the algorithms used to determine storm significance and establish the storm track. Results of the two-year development effort and operational tests show the usefulness of assimilating large amounts of complex data and generating a computer-synthesized product easily used in forecast applications. The error analysis performed on the storm track forecast accuracy suggests that few of the errors encountered are due to meteorological effects but they are largely due to parameters such as beam width, pulse width, antenna rotation rate and rounding errors. The non-meteorological errors appear to average out over large data sets; that is, the longer the storm track the smaller the forecast error. Although the program now uses a three-dimensional analysis, very little analysis is performed on the velocity and variance fields. The usefulness of these fields along with other improvements are considered. GRA

N81-28670# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
COMPARISON OF FOG DROP SIZE SPECTRA MEASURED BY LIGHT SCATTERING AND IMPACTION TECHNIQUES Scientific Interim Report
Bruce A. Kunkel 10 Feb. 1981 39 p refs
(AF Proj. 6670)
(AD-A100252; AFGL-TR-81-0049; AFGL-ERP-727) Avail: NTIS HC A03/MF A01 CSCL 04/2

A comparison was made between the drop size data obtained with a PMS FSSP-100 and a Calspan droplet sampler. Above 4 micrometers radius, the data from the two instruments agree quite well. Below 4 micrometers, however, the Calspan sampler shows a decrease in droplet count with decreasing radius whereas the FSSP shows an increase in count with decreasing radius.

As a result, in natural fogs the Calspan sampler frequently shows a mode in the droplet concentration between 4 and 8 micrometers whereas the FSSP frequently shows no mode in droplet concentration existing within the drop size range of the instrument. In the simulated fogs, where the concentration of small particles was low, the modes agree very well. Since the droplets below a micrometers contribute little to the liquid water, there is excellent agreement in the distribution of liquid water with particle size for both simulated and natural fog. The extinction coefficients calculated from the FSSP drop size distribution are lower than the measurement extinction coefficients in the lighter fogs but larger in the denser fogs. GRA

N81-28671# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

A PRELIMINARY ASSESSMENT OF THE MONOSTATIC SOUNDER AS A FORECAST AID IN THE PREDICTION OF ADVECTION FOGS AT A MASSACHUSETTS COASTAL STATION Scientific Interim Report

Bruce A. Kunkel 6 Nov. 1980 19 p refs
(AF Proj. 6670)
(AD-A100271; AFGL-TR-80-0341; AFGL-ERP-718) Avail: NTIS HC A02/MF A01 CSCL 04/2

A monostatic acoustic sounder was installed at the AFGL Weather Test Facility at Otis AFB, Massachusetts. Data were collected during 18 fog cases that occurred during the 1979 fog season. These data were used to conduct a preliminary evaluation of the usefulness of the monostatic acoustic sounder for predicting the occurrence and dissipation of east coast maritime fogs, and to learn more about the structure and evolutionary processes of the fog life cycle. Results indicate that the inversion height data obtained from the sounder, and information on the lifting condensation level, can be used to predict the occurrence of stratus and the probability of a fog event. The sounder provides no information, however, that would be useful in predicting the onset time of the fog event. There is some evidence of turbulent mixing causing the fog to lift, and low level convergence causing the fog to form. Author (GRA)

N81-28672# Air Force Global Weather Central, Offutt AFB, Nebraska.

MAP PROJECTIONS AND GRID SYSTEMS FOR METEOROLOGICAL APPLICATIONS

James E. Hoke, John L. Hayes, and Larry G. Renninger Mar. 1981 103 p refs
(AD-A100324; AD-E850076; AFGWC/TN-79/003) Avail: NTIS HC A06/MF A01 CSCL 04/2

This Technical Note describes the maps and grids currently used at the Air Force Global Weather Central (AFGWC) to provide conventional meteorological support. It does not discuss those used for space environmental support, however. The emphasis is on the mathematical equations needed for proper Earth location of meteorological data on both maps and grids. This Technical Note is intended to serve as a reference for programmers. In addition, it provides information for users of AFGWC products and the meteorological community at large. GRA

N81-28673# Air Force Global Weather Central, Offutt AFB, Nebraska.

TOTAL ELECTRON CONTENT FORECASTING AT AFGWC

James A. Manley Feb. 1981 21 p refs
(AD-A100325; AD-E850075; AFGWC/TN-81/002) Avail: NTIS HC A02/MF A01 CSCL 04/2

The Space Forecasting Branch of the Air Force Global Weather Central (AFGWC) produces TEC forecasts for a variety of users. This technical note provides a qualitative assessment of this forecasting effort during the previous five year period. GRA

N81-28674# Naval Postgraduate School, Monterey, Calif.

DYNAMICS OF TROPICAL WAVES AND MONSOONS Final Report, Sep. 1977 - Oct. 1980

Chih-Pei Chang and Roger T. Williams Apr. 1981 171 p refs
(Grant NSF ATM-77-14821)
(AD-A100479; NPS-63-81-001) Avail: NTIS HC A08/MF A01 CSCL 04/2

Asian monsoons represent a substantial portion of the energy of the global atmospheric circulation. This research studies the large scale motions of the monsoons, in terms of their structure, development, maintenance and the interrelationships between them. The research includes: (1) Synoptic scale diagnostic studies of the winter monsoon--The main results suggest the importance of cold surge-forced low level convergence in the enhancement of organized convection in synoptic disturbances; (2) Planetary scale diagnostic studies of the winter monsoon--Results suggest a coherent variation of the local Hadley and Walker circulations, and East and West Asia jet stream during cold surges; (3) Linear theoretical studies of waves in a variable mean flow--Results show the importance of barotropical growth of linear waves downstream from the most unstable part of the summer monsoon easterly jet; (4) East Asia monsoon trough during early summer--Structure and dynamic differences are diagnosed between different segments (more tropical vs. more mid-latitude) of this subtropical system; and (5) Simple modeling studies of monsoon variations--Domain-averaged, atmosphere-ocean coupled model simulation demonstrates the strong interplay that influences the active and break cycles of the monsoons. GRA

N81-28675# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

ATMOSPHERIC DATA REQUIREMENTS FOR BATTLEFIELD OBSCURATION APPLICATIONS Final Report

E. H. Holt Jun. 1980 85 p refs
(AD-A100398; ERADCOM/ASL-TR-0061) Avail: NTIS HC A05/MF A01 CSCL 04/1

This report identifies current and future basic atmospheric data requirements--including estimates of sensing range, accuracy, and resolution--that are needed to assess and describe appropriate atmospheric effects on US Army weapons systems which involve the propagation of electromagnetic energy through the atmosphere. The approach taken is user oriented, with the following types of users being identified: atmospheric modelers, weapons systems designers, weapons systems developers, operational test and evaluation practitioners, and war game players. A section is also devoted to weather applications and possible needs of troop trainers and tactical decision makers, that is, field commanders. Although some commonality of data requirements does exist across the spectrum of users, this report points out differences in individual user needs for atmospheric data to support Army electro-optical and near-millimeter wave weapons systems. Comments are also included that address the all-important question as to what should constitute a minimum atmospheric data set that is adequate to support the total life cycle of electro-optical weapons systems from conception through deployment. Author (GRA)

N81-28676# Army Test and Evaluation Command, Fort Huachuca, Ariz.

METEOROLOGICAL DATA FOR TESTING. REPORT ON TEST OPERATIONS PROCEDURE Final Report

2 Jun. 1981 23 p refs Supersedes MTP-3-1-003
(AD-A100415; TOP-3-1-003; MTP-3-1-003) Avail: NTIS HC A02/MF A01 CSCL 04/2

This TOP describes procedures for obtaining meteorological data. These data may then be used during or in support of many types of tests or during data reduction to normalize recorded weapon test data. This TOP is designed mainly to provide the test director with available meteorological information; specific data needed for a test are stipulated in the various applicable TOPs. GRA

N81-28677# Atmospheric Research Corp., Norman, Okla.

A MULTIVARIATE AUTOREGRESSIVE FORECAST MODEL FOR SHORT-TERM PREDICTIONS Final Report

James S. Goerss White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Apr. 1981 53 p refs
(Contract DAAG29-72-D-0100; DA proj. 1L1-62111-AH-71)
(AD-A100465; ERADCOM/ASL-CR-81-0100-4) Avail: NTIS HC A04/MF A01 CSCL 04/2

Data from 3 years (1972-1974) of synoptic observations collected at seven German stations were used to determine multivariate autoregressive (MVAR) models to make short-term forecasts (3 to 12 hours) for six atmospheric variables (temperature, u-wind, v-wind, visibility, ceiling height, and height of first cloud layer). So that certain tactical constraints could be met, the order and number of predictor variables used by the MVAR models were limited. To emphasize the variance of low ceiling

and visibility situations, a variable transformation was performed upon the observations of visibility and the cloud height variables. The best forecasts were obtained when six seven-parameter MVAR models were used. Each model produces a forecast for a particular variable, using the observations at the seven stations as parameters. The variables that can be forecast best are temperature and the u- and v-components of the wind with about 95, 75, and 60 percent of the variance, respectively, explained by the model. From 45 to 70 percent of the variance is explained by the model for visibility while from 30 to 60 percent is explained for the cloud height variables. Finally, data from observations collected in 1976 were used in testing the MVAR models, and the error statistics from these actual forecasts agreed with theory. Author (GRA)

N81-28678# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN AUTOMATED CLOUD OBSERVATION SYSTEM (ACOS)
Edward B. Geisler 17 Dec. 1980 27 p refs
(AF Proj. 6670)
(AD-A100266; AFGL-TR-81-0002; AFGL-ERP-722) Avail: NTIS HC A03/MF A01 CSCL 04/2

Analysis of cloud base height data collected during a seven-month period from a three Rotating Beam Ceilometer (RBC) network on Otis AFB, Massachusetts, demonstrated the accuracy of an automated cloud observation system. The high degree of correspondence between the automated and human observations of cloud height, low cloud amount, multiple cloud layers, and ceiling confirms the accuracy of the hierarchical clustering technique when applied to a network of RBC's confined to the immediate environs of an airfield. Tests demonstrated only slight improvements in automated cloud observation are realized by incorporating additional information from a second and third RBC on or near an airfield. Author (GRA)

N81-28679# Florida State Univ., Tallahassee. Dept. of Meteorology and Oceanography.
ON THE DYNAMICAL RESPONSE OF THE SUBARCTIC FRONT TO MOMENTUM TRANSFER
Alejandro Livio Camerlengo Mar. 1981 106 p refs
(Contracts N00014-75-C-0201; N00014-80-C-0076)
(AD-A100326; Rept-180) Avail: NTIS HC A06/MF A01 CSCL 08/10

Theoretical studies and numerical experiments of the subarctic front are conducted. The theoretical side of this research encompasses the determination of a stability criterion and the role friction plays as a dissipative mechanism. It is established that the phase speed of the first baroclinic mode is larger in a numerical model where a constant density jump between layers is employed. Thus, a smaller time scale is required to avoid the numerical instability caused by the violation of the CFL criterion. A numerical four-layer hydrodynamical model is implemented to investigate the role the atmosphere exerts on the dynamics of the subarctic front. The salient features at the wake of a strong cyclone can be summarized as follows: upwelling of 20 meters of the four interfaces occurs; the water remains upwelled for several weeks; the e-folding time scale of the vertical oscillations induced by the storm's passage is of the order of 10 days; a region of relative maximum convergence is observed in the lower layers below a region of relative maximum upwelling in the upper layer; and the long and cross-front velocity fields are in quadrature in time, with the cross front velocity lagging the long front velocity. With the exception of the cyclone's case, it is established that the effects of the atmospheric wind forcing are confined to the upper layer. These results are supported by oceanic observations. GRA

N81-28680# Pennsylvania State Univ., University Park. Dept. of Meteorology.
ESTIMATION OF VERTICAL WIND SHEAR FROM INFRARED AND MICROWAVE RADIANCES Final Report, 1 Dec. 1979 - 30 Apr. 1981
Hans A. Panofsky, John J. Cahir, Anthony Cavalier, and Frederick Gadomski Apr. 1981 76 p refs
(Contract N00014-80-C-0115; NR Proj. 123-302)
(AD-A100439) Avail: NTIS HC A05/MF A01 CSCL 04/2

Linear regression estimates of radiosonde observed vertical wind shears between mandatory levels were made, using radiance gradients obtained via the TIROS-N satellite as predictors in a pilot experiment based on about 200-500 observations. The best results were obtained for shears between 850 mb and a level in the upper troposphere, such as 300 mb Results were similar for 850 to 400 or 850 to 200 mb shears, but notably inferior for 850 to 500 mb shears. The linear correlation coefficients between estimated and smoothed observed components of shear was about 0.70, corresponding to about 50 percent explained variance in independent test samples. Somewhat higher explained variances (about 0.60) were achieved in a limited trial where the data-set was stratified according to subjectively-judged trajectory curvature. Estimates of the wind itself in the upper troposphere were nearly as skillful as the best shear results. Overall, with the possible exception of curvature-stratified estimates in clear regions, both wind and wind shear estimates are not likely to be superior to methods that generate RMS wind errors of order 5m/s. GRA

N81-28681# Battelle Pacific Northwest Labs., Richland, Wash.
WIND ENERGY RESOURCE ATLAS. VOLUME 7: THE SOUTH CENTRAL REGION
R. L. Edwards, L. F. Graves, A. C. Sprankle, A. C. Elliott, W. R. Barchet, and R. L. George Mar. 1981 238 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-7) Avail: NTIS HC A11/MF A01

This atlas of the south central region combines seven collections of wind resource data: one for the region, and one for each of the six states (Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas). At the state level, features of the climate, topography, and wind resources are discussed in greater detail than that provided in the regional discussion, and the data locations on which the assessment is based are mapped. Variations over several time scales, in the wind resource at selected stations in each state are shown on graphs of monthly average and interannual wind speed and power, and hourly average wind speed for each season. Other graphs present speed, direction, and duration frequencies of the wind at these locations. DOE

N81-28682# Battelle Pacific Northwest Labs., Richland, Wash.
WIND ENERGY RESOURCE ATLAS. VOLUME 12: PUERTO RICO AND US VIRGIN ISLANDS
H. L. Wegley, D. L. Elliott, W. R. Barchet, and R. L. George Jan. 1981 93 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-12) Avail: NTIS HC A05/MF A01

The Puerto Rico/US Virgin Island atlas assimilates three collections of wind resource data: one for the region as a whole and one each for both the Commonwealth of Puerto Rico and the US Virgin Islands. For the two subregions, features of the climate, topography and wind resource are discussed in greater detail than is provided in the regional discussion, and the data locations on which the assessment is based are mapped. Variations, over several time scales, in the wind resource at selected stations in both subregions are shown on graphs of monthly average and interannual wind speed and power, and hourly average wind speed for each season. Other graphs present speed, direction and duration frequencies of the wind at these locations. DOE

N81-28683# Battelle Pacific Northwest Labs., Richland, Wash.
WIND ENERGY RESOURCE ATLAS. VOLUME 8: THE SOUTHERN ROCKY MOUNTAIN REGION
S. R. Anderson, D. L. Freeman, D. L. Hadley, D. L. Elliott, W. R. Barchet, and R. L. George Mar. 1981 178 p refs Prepared in cooperation with Western Scientific Services, Inc., Fort Collins, Colo.
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-8) Avail: NTIS HC A09/MF A01

The Southern Rocky Mountain atlas assimilates five collections on wind resource data: one for the region and one for each of the four states that compose the Southern Rocky Mountain region (Arizona, Colorado, New Mexico, and Utah). At the state level, features of the climate, topography and wind resource are discussed in greater detail than is provided in the regional discussion, and the data locations on which the assessment is based are mapped. Variations, over several time scales, in the wind resource at selected stations in each state are shown on graphs of monthly average and interannual wind speed and power,

and hourly average wind speed for each season. Other graphs present speed, direction, and duration frequencies of the wind at these locations. DOE

N81-28684# Battelle Pacific Northwest Labs., Richland, Wash.
PRACTICAL METHOD FOR ESTIMATING WIND CHARACTERISTICS AT POTENTIAL WIND ENERGY CONVERSION SITES
R. M. Endlich, F. L. Ludwig, C. M. Bhumralkar, and M. A. Estoque Aug. 1980 165 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3808) Avail: NTIS HC A08/MF A01

A method is developed to compute local winds for use in estimating the wind energy available at any potential site for a wind turbine. The method uses the terrain heights for an area surrounding the site and a series of wind and pressure reports from the nearest four or five national Weather Service stations. An initial estimate of the winds in the atmospheric boundary layer is made, then these winds are adjusted to satisfy the continuity equation. In this manner the flow is made to reflect the influences of the terrain and the shape of the boundary layer top. Descriptions of the computer programs, instructions for using them, and complete program listings are included. DOE

N81-28685# Brookhaven National Lab., Upton, N. Y. Atmospheric Sciences Div.
MARINE BOUNDARY LAYER WIND STRUCTURE OVER THE BAY OF BENGAL DURING MONEX79
S. SethuRaman 1981 5 p refs Presented at the Intern. Symp. on Early Results of FGGE-MONEX Expts, Tallahassee, 12-17 Jan. 1981
(Contract DE-AC02-76CH-00016)
(BNL-29260; CONF-810133-1) Avail: NTIS HC A02/MF A01

A marine boundary layer experiment was conducted at Digha, West Bengal, India, to determine the role of the atmospheric boundary layer on the Bay of Bengal cyclogenesis. The boundary layer experiment at Digha consisted of three main components: (1) a 10 m micrometeorological tower at the beach with instruments to observe turbulent fluxes of heat and momentum over the ocean; (2) a weather station that continuously recorded mean parameters; and (3) pilot balloon observations to a height of about 1000 m. Some of the preliminary results obtained through the analysis of the data are discussed. DOE

N81-28686# California Univ., Livermore. Lawrence Livermore Lab.
OBSERVED TURBULENCE INTENSITIES IN A DESERT BOUNDARY LAYER
J. H. Shinn and R. T. Cederwall Oct. 1980 3 p refs Presented at the 5th Symp. on Turbulence, Diffusion, and Air Pollution, Columbia, Mo., 9-13 Mar. 1981
(Contract W-7405-eng-48)
(UCRL-84672; CONF-810306-6) Avail: NTIS HC A02/MF A01

Applied problems in atmospheric dispersion require the prediction of vertical and lateral turbulence intensities near the ground as a function of the coal atmospheric stability were investigated over a wide range of stabilities at two desert sites in Nevada and California. The data collected at Frenchman Flat (Nevada Test Site) during neutral and stable cases are different from those of other published studies and lead to the hypothesis that, under certain conditions, different semi-empirical approaches are required to predict turbulence intensities. DOE

N81-28687# Aspen Inst. for Humanistic Studies, Boulder, Colo.
MECHANISM FOR THE EFFECTS OF VARIABLE SOLAR ACTIVITY ON THE WEATHER Final Report
1981 6 p refs
(Contracts DE-AS02-78ER-04634; ER-78-S-02-4634)
(DOE/ER-04634/1) Avail: NTIS HC A02/MF A01

Physical mechanisms for the effects of variable solar activity on the weather were identified. The empirical method was chosen for the following reasons: (1) to tap the great pool of scientific talent able to offer sound physical mechanisms, it is necessary to demonstrate that there are some important relationships to explain; and (2) if the experiments are carefully designed, they can eliminate certain mechanisms which seem to have a low probability of success, and pick out the mechanisms which look more promising. DOE

N81-28688# Royal Netherlands Meteorological Inst., De Bilt.
MARINE CLIMATOLOGICAL SUMMARIES FOR THE MEDITERRANEAN AND SOUTHERN INDIAN OCEAN, VOLUME 8
1980 488 p
(KNMI-151-8) Avail: NTIS HC A21/MF A01

Summaries of shipboard observations made in eight areas representative of the Mediterranean Sea and thirteen areas representative of the Indian Ocean and Australian waters are presented. Each set of tables gives the mean monthly position of the observations, a map of the area, cloud cover, dry bulb, dewpoint and sea surface temperatures, air-sea temperature difference, winds and pressure. Horizontal visibility, present weather, and wave data are also provided. Author (ESA)

N81-28689# Kiruna Geophysical Inst. (Sweden).
THE SPECTRAL HARDENING ASSOCIATED WITH THE WESTWARD TRAVELING SURGE
Ake Steen and Georg Gustafsson Dec. 1980 17 p refs
(KGI-80-3; ISSN-0347-6405) Avail: NTIS HC A02/MF A01

Photometer recordings of auroral emissions demonstrate that the ratios between the emissions show a characteristic plateau just prior to the passage of a westward traveling surge. The plateau may be interpreted as a temporary (about one minute) cessation in the spectral hardening of the precipitating particles associated with the surge. The characteristic energy of the plateau is about one keV above the level prior to the beginning of the surge. The results are interpreted in terms of an instability that is switched on during the time of the plateau and then turned off when the electron density is increased above a certain limit. Author (ESA)

N81-28690# Research Triangle Inst., Research Triangle Park, N. C.
OPTIMUM METEOROLOGICAL AND AIR POLLUTION SAMPLING NETWORK SELECTION IN CITIES. VOLUME 3: OBJECTIVE VARIATIONAL ANALYSIS MODEL
Walter D. Bach, Jr. and Fred M. Vukovich Mar. 1981 69 p refs
(Contract EPA-68-03-2187)
(PB81-172256; EPA-600/4-81-012) Avail: NTIS HC A04/MF A01 CSCL 04B

The development and application to St. Louis of the Objective Variational Analysis Model (OVAM), which is used to provide the air pollution distribution, is discussed. The OVAM produces an analysis of air quality in an area by solving an Euler-Lagrange equation that minimizes the weighted error variance between the analysis and observations and between the analysis and the solution from the equation of mass continuity. T.M.

N81-28691# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CLOUD PHYSICS STUDIES IN SCPP (SIERRA COOPERATIVE PILOT PROJECT) Annual Report, 1979 - 1980
Ronald E. Stewart and John D. Marwitz Oct. 1980 104 p refs
(Contract DI-7-07-83-V0001)
(PB81-176604; AS125) Avail: NTIS HC A06/MF A01 CSCL 04B

Microphysical seeding effects in a severely sheared stratiform cloud which had a liquid water content of less than 0.1 g/cu m are discussed. The seeding effects in a stratiform cloud which had very low liquid water content are also discussed. The three seeding modes were AgI flares, CO2 pellets and a placebo. Calculations of the horizontal spread of seeding curtains caused by wind shear and ice crystal terminal velocities are presented. GRA

N81-28692# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
MICROPHYSICAL AND THERMODYNAMIC CHARACTERISTICS THROUGH THE MELTING LAYER Scientific Report
John C. Pace Dec. 1980 224 p refs
(Contract DI-7-07-83-V0001)
(PB81-177719; AS126) Avail: NTIS HC A10/MF A01 CSCL 04B

A theoretical model of melting layer development is discussed and observations are presented which were made within three widespread, stratiform, precipitating clouds containing distinct radar bright bands. The results of the theoretical model show that melting particles can quickly produce deep isothermal layers at OC in modern precipitation. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-28693 Columbia Univ., New York.
EDDIES OF THE WESTERN ARCTIC OCEAN: THEIR CHARACTERISTICS AND IMPORTANCE TO THE ENERGY, HEAT AND SALT BALANCE Ph.D. Thesis
Thomas Owen Manley 1981 225 p
Avail: Univ. Microfilms Order No. 8113536

With the undertaking of the main 1975-76 AIDJEX experiment located in the central Beaufort Sea, four manned camps collected for one year the largest and most complete set of oceanographic data within the Artic Ocean to this date. Using T-S signatures, 31 of the 146 crossing are found to represent duplicate crossings of 12 individual eddies making a total of 127 separate eddies observed during the one year. On the basis of the AIDJEX data set, arctic eddies are found to: (1) be prevalent in the Beaufort Sea: (2) reside in the depth range of 50 to 300 meters although deeper eddies are also present: (3) contain more than half of the total amount of kinetic energy in the upper 200 m of the Beaufort Sea:(4) transfer kinetic energy to the mean flow:(5) be predominately anticyclonic in their rotational tendency:(6) transfer fresher less saline water into the deep Arctic Ocean from the Chukchi Sea:(7) transfer both warm and cold water into the deep Arctic Ocean in response to the seasonally changing shelf conditions. Dissert. Abstr.

N81-28694 Florida State Univ., Tallahassee.
ON THE DYNAMICAL RESPONSE OF THE SUBARCTIC FRONT TO MOMENTUM TRANSFER Ph.D. Thesis
Alejandro Livio Camerlengo 1981 102 p
Avail: Univ. Microfilms Order No. 8113256

Theoretical studies and numerical experiments of the subarctic front are conducted. It is established that if the difference between the phase speed of the perturbation and the mean long front geostrophic flow is greater than a certain value, the subarctic front is stable everywhere. It is also proved that the time scale of dissipation is sufficiently large to neglect horizontal friction. While the effect of the westerly winds causes a southward shift of the front, the effect of a negative curl shows convergence at the front. This convergence strongly favors frontogenesis. It is established that the phase speed of the first baroclinic mode is larger in a numerical model where a constant density jump between layers is employed. Dissert. Abstr.

N81-28695 Florida State Univ., Tallahassee.
A NUMERICAL MODEL OF COASTAL UPWELLING OFF PERU, INCLUDING MIXED LAYER DYNAMICS Ph.D. Thesis
George Washington Heburn 1980 140 p
Avail: Univ. Microfilms Order No. 8113263

Two versions of an x-y-t, two layer, numerical model with realistic coastline and bottom topography on a rotated beta plane are used to study the upwelling system. A hydrodynamic version of the model with two homogeneous layers is used to examine the interaction between the bottom topography and coastal trapped waves. The fluctuations in the undercurrent off the Peruvian coast are uncorrelated with the local winds. The hypothesis is that these fluctuations are the result of coastal trapped Kelvin waves. A parameterization scheme, based on Kelvin wave dynamics is introduced to simulate these coastal trapped waves. The relationship between bottom topographic features and the pycnocline height anomalies for a longshore current event is then examined. The principle of conservation of potential vorticity is used to explain the interactions between the waves and the bottom topography. Dissert. Abstr.

N81-28696# Colorado Univ. at Boulder. Dept. of Astro-Geophysics.
NUMERICAL TECHNIQUES FOR OCEAN FORECASTING Final Report, 1 Jul. 1978 - 30 Sep. 1980
Eric Graham and John E. Hart 30 Sep. 1980 69 p refs
(Contract N00014-78-C-0706)
(AD-A100362) Avail: NTIS HC A04/MF A01 CSCL 08/8

The general equations that describe the flow of the ocean are well known, but for many cases of interest, analytical solutions are not possible because of irregular boundaries or significant non-linearities in the equations. It is often possible to obtain useful approximate solutions using numerical techniques. However, for reasonably detailed numerical models, very large amounts of computer time are required, and it becomes imperative to seek out the most efficient numerical algorithm. In the case where forecasts are being made on a real time basis, the use of non-optimum schemes may result in unacceptable delays. This report describes a class of techniques for the efficient treatment of bodies of water with irregular boundaries. Realistic models of the ocean state must include adequate treatment of the boundaries, the irregular bottom topography, the shape of the coastline and the complicated geometry of groups of islands. Traditional numerical methods using a rectangular finite difference grid are suitable for exploratory surveys of idealised problems where the aim is to see why a particular system responds as it does, and what effects variations in the parameters of the problem and the forcing terms have on the outcome. GRA

N81-28697# Sandia Labs., Albuquerque, N. Mex. Seabed Programs Div.
PHYSICAL OCEANOGRAPHIC CHARACTERISTICS INFLUENCING THE DISPERSION OF DISSOLVED TRACERS RELEASED AT THE SEA FLOOR IN SELECTED DEEP OCEAN STUDY AREAS
Stuart L. Kupferman and Douglas E. Moore (Woods Hole Oceanographic Inst., Mass.) Feb. 1981 28 p refs Presented at the 2nd Intern. Ocean Disposal Symp., Woods Hole, Mass., 15-18 Apr. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2573; CONF-800420-6) Avail: NTIS HC A03/MF A01

Scenarios which follow the development in space and time of the concentration field of a dissolved tracer released at the sea floor are presented for a Pacific and two Atlantic study areas. The scenarios are closely tied to available data by means of simple analytical models and proceed in stages from short time and space scales in the immediate vicinity of a release point to those scales characteristic of ocean basins. The concepts of internal mixing time and residence time in the benthic mixed layer, useful for developing an intuitive feeling for the behavior of a tracer in this feature, are introduced and discussed. Reliable estimation of mixing requires careful consideration of the dynamics of the eddy fields in the ocean. Dissert. Abstr.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-28698* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INDIRECT MICROBIAL DETECTION Patent
Judd R. Wilkins, inventor (to NASA) Issued 28 Apr. 1981 8 p Filed 17 Aug. 1979 Supersedes N80-11756 (18 - 02, p 0241
(NASA-Case-LAR-12520-1; US-Patent-4,264,728; US-Patent-Appl-SN-067596; US-Patent-Class-435-5; US-Patent-Class-204-1T; US-Patent-Class-204-195B; US-Patent-Class-435-34; US-Patent-Class-435-291) Avail: US Patent and Trademark Office CSCL 06M

The growth of microorganisms in a sample is detected and monitored by culturing microorganisms in a growth medium and detecting a change in potential between two electrodes, separated from the microbial growth by a barrier which is permeable to charged paticles but microorganism impermeable.

Official Gazette of the U.S. Patent and Trademark Office

N81-28699# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOL. 14, NO. 6

4 Feb. 1981 140 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 3-86

(JPRS-77311) Avail: NTIS HC A07/MF A01

Laboratory tests were performed on men and animals to determine the effects of aerospace or underwater environments on performance and work capacity. Cardiovasculas, musculoskeletal and hormonal systems were monitored to determine body response to weightlessness and other dimensions of space flight stress. For individual titles, see N81-28700 through N81-28721.

N81-28700# Joint Publications Research Service, Arlington, Va.

MAXIMUM OXYGEN UPTAKE AS A CRITERION OF HUMAN RESISTANCE TO HYPOXIA, HYPERTHERMIA AND HYPOTHERMIA c52

A. M. Vasilenko *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 1-10 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 3-10 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Physical work capacity is shown to be a adequate indicator of human tolerance to adverse environmental effects. Maximum oxygen uptake being a measure of physical work capacity, is used as a prognostic indicator of human tolerance and adaptive capability in a hypoxic, high or low ambient temperature environment. Increase in maximum oxygen uptake under the influence of training or adaptation to hypoxia is accompanied by increase in heat and cold resistance. Author

N81-28701# Joint Publications Research Service, Arlington, Va.

STUDY OF HEMODYNAMICS AND PHASE STRUCTURE OF CARDIAC CYCLE IN SECOND CREW OF THE SALYUT-6 ORBITAL STATION AT REST c52

A. D. Yegorov, O. G. Itsekhovskiy, I. I. Kasya, I. V. Alferova, A. P. Polyakova, V. F. Turchaninova, V. I. Bernadskiy, V. G. Doroshev, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 11-15 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmiheskaya Med. (USSR), v. 14, no. 6, 1980 p 10-14 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

During the 140 day flight of the Salyut-6 station cardiovascular examinations were carried out at rest. They showed blood redistribution and hypervolemia of the upper body. They also demonstrated increases in the circulating blood volume and pulse blood filling of cerebral vessels, development of the phase preload syndrome ad simultaneous decrease in blood filling of leg vessels. These changes varied phasically in the course of flight. Weightlessness of up to 140 days did not cause any pathologies in the cardiovascular system. Author

N81-28702# Joint Publications Research Service, Arlington, Va.

CHANGES IN HEMOGLOBIN MASS DURING REAL AND SIMULATED SPACE FLIGHTS c52

I. S. Balakhovskiy, V. I. Legenkov, and R. K. Kiselev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 16-23 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 14-20 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Following space missions of more than two weeks the hemoglobin content decreased. The largest reduction of this parameter was seen after flights of 1 to 2 months (25 - 33 percent of the initial value). In the recovery period the reticulocyte count increased, reaching maximum at the end of the second and the beginning of the third week. Author

N81-28703# Joint Publications Research Service, Arlington, Va.

THEORETICAL LEFT VENTRICULAR EJECTION PERIOD IN WEIGHTLESSNESS c52

V. A. Degtyarev, N. A. Lapshina, and L. Ya. Andriyako *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 24-28 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 20-23 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The relationship between duration of blood ejection and cadiac cycle at rest is described by a linear function. This relationship is maintained in weightlessness as well. The derived formula used in calculations of the election phase during an exposure to lower body negative pressure (LBNP) makes it possible to predict LBNP test tolerance in the weightless state. The level of deviation of factual values of heart rate from theoretical values is an additional index used in assessing health status of crewmembers inflight. Author

N81-28704# Joint Publications Research Service, Arlington, Va.

SLEEP DISTINCTIONS, CIRCADIAN RHYTHM OF PHYSIOLOGICAL FUNCTIONS AND EFFICIENCY OF MAN ON FIRST DAY AFTER SHIFT IN SLEEPING-WAKING CYCLE c52

A. N. Litsov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 29-35 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 23-28 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Physiological reactions of 35 male test subjects, aged 25 to 42, were examined during the first day after a 3 to 11 hour work-rest cycle shift within 24 hours. The sift induced noticeable changes in sleep dynamics. Shifts close to inversion (9- and 11-hours) were accompanied by disturbances in the diurnal rhythm of heart rate and may cause deterioration of mental productivity. Negative effects of such time schedules need to be taken into consideration, when developing work-rest regimens for representatives of different occupations. Author

N81-28705# Joint Publications Research Service, Arlington, Va.

HISTAMINE AND SEROTONIN LEVELS IN MAN IN THE PRESENCE OF NERVOUS-EMOTIONAL STRESS c52

S. Kalandarov, I. D. Frenkel, and L. I. Nekrasova *In its* USSR Rept.: Space Biol. and Areospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 36-40 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no 6, 1980 p 29-32 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Levels of histamine and serotonin in blood of test subjects kept on a Salyut space diet were measured during their simulated rise to an altitude of 8,000 m, anticipation of an exposure to acceleration and mental work. During simulated rise the level of histamine increased and histaminopectic activity of serum decreased. During anticipation of configuration the serotonin concentration grew. Levels of histamine and serotonin did not vary significantly in the test subjects kept on the space diet with certain food supplements. Author

N81-28706# Joint Publications Research Service, Arlington, Va.

MOTOR ACTIVITY OF MAN WHEN IT IS ARTIFICIALLY RESTRICTED c52

N. Ye. Panferova and V. I. Pervushin *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 41-44 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 32-35 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

During a prolonged exposure to an altitude chamber (37 to 120 days), man's motor activity decreases 3- or 4-fold: from 15 to 19 thousand, to 2 to 4 thousand steps per day. During a prolonged restraint in a chair in the position of an average physiological rest the number of movements falls to 5 to 7 per hour. The change of motor activity during hypodynamics and recovery follows three stages: an acute change; a slow change; and a stage of stabilization at a new level. It is shown that the

people who find themselves in a environment limiting their physical activity do not have the need for an additional workload. Author

N81-28707# Joint Publications Research Service, Arlington, Va.

MORPHOLOGICAL CHANGES IN DIFFERENT TYPES OF RAT MUSCLE FIBERS DURING LONG-TERM HYPOKINESIA

S. Kurash, A. Andzheyevska, and Ya. Gurski *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 45-52 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 35-41 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Morphological changes in different type muscle fibers of rats kept for 30 days in small enclosures were investigated. The white muscle (the uppermost layer of the musculus vastus lateralis) showed the smallest changes. In the red muscle (the innermost layer of the m. vastus lateralis) the most significant changes were seen in contractile elements, which involved lesions in Z bands. The most hypokinesia-sensitive muscle was the m. soleus, an intermediate muscle, were degenerative and atrophic changes developed in most fibers and involved all structural elements. Author

N81-28708# Joint Publications Research Service, Arlington, Va.

CORTICOSTEROID CONTENT OF RAT ADRENALS IN THE PRESENCE OF HYPOKINESIA COMBINED WITH GRADED PHYSICAL EXERCISE

Ye. A. Zagorskaya *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 53-56 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 41-44 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Data are presented on the content of corticosteroids in adrenals of rats exposed to 46, 53 and 60 day hypokinesia as well as 60 day hypokinesia combined with graded exercises. It was found that the content of corticosteroids in adrenals remained essentially unaltered after 46 day hypokinesia, decreased after 53 day hypokinesia and increased after 60 day hypokinesia as compared to the appropriate controls. The use of exercises demonstrated good reserve capabilities of the hypophyseal adrenal system of rats after 60 day hypokinesia and revealed certain changes in regulatory mechanisms of the hypophysis adrenal cortex system. Author

N81-28709# Joint Publications Research Service, Arlington, Va.

COMPARATIVE EFFICACY OF VARIOUS BIOLOGICALLY ACTIVE COMPOUNDS DURING EXERCISE c52

V. S. Shashkov and N. G. Lakota *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 57-65 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 44-51 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Over 30 drugs and recipes were assessed in 440 provocative bicycle ergometry tests PWC 170 and individual tolerance (IT) tests in which 63 healthy volunteers participated. In the study the IT test was physiologically substantiated, and performance evaluation based on PWC 170, when heart rate influencing drugs were taken, was shown to be incorrect. In the course of normal and forced breathing (gas exchange measurements) quantitative variations of PWC170 were recorded. The combination of the two tests, having criterion properties subjected to the rank evaluation, are recommended as a method for determining physical work capacity and testing drug efficiency. During an exposure to adverse environments or functional, humoral or integrative stresses the following drugs can be prescribed: drugs classified as adaptogens of the U.S.S.R. flora; multicomponent tonic recipes, containing aminoacids, metabolites, adaptogens, vitamins and metal compounds; recipes containing aminoacids and anabolics as well as low doses of central nervous system stimulants. S.F.

N81-28710# Joint Publications Research Service, Arlington, Va.

CHANGES IN ANIMAL REACTIVITY UNDER THE INFLUENCE OF PROLONGED ROTATION

N. I. Arlashchenko and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 66-70 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 51-54 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Rabbit experiments demonstrated that a prolonged (up to 14 days) rotation at a rate of 7 rpm in a 110 cm arm rotating system alters reactivity of the animal body as follows from measurements of radioresistance, vestibular reactivity, and barrier function of eye vessels, thus indicating increase in general resistance to environmental effects. Author

N81-28711# Joint Publications Research Service, Arlington, Va.

EFFECT OF SIMULATED GRAVITY ON THE CHICK EMBRYO MYOCARDIUM

S. S. Oganesyan, R. A. Gevorkyan, T. S. Zaminyan, and M. A. Eloyan *In its* USSR Rept.: Space Biol. and Aerospace Med., v. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 71-75 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 54-57 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

Daily centrifugation of 5 to 8 day embryos at 7 G for 20 min by means of a specially designed attachment decreased the amplitude and increased the rate of rhythmic activity of ventricular myocytes, the automatic activity of atrial pacemakers remaining unaltered. These changes were accompanied by a decrease in $Ca2+$ sensitivity of myocytes. Daily centrifugation of 11 to 20 day chick embryos led to myocardial hypertrophy and increase in the diameter of myocardiocytes as well as to increase in the content of actin, troponin T and the second light chain of myosin, increase in the content of tropomyosin and emergence of the third light chain of myosin in the electrophoregrams. Changes in the composition of protein subunits of the contractile system are induced by activation of proteolytic enzymes in the muscle tissue. Author

N81-28712# Joint Publications Research Service, Arlington, Va.

RELATIONSHIP BETWEEN PULSED FILLING OF EARLOBE VESSELS AND CARDIAC EXTRASYSTOLE DURING HEAD-PELVIS ACCELERATIONS AFTER EXPOSURE TO SIMULATED WEIGHTLESSNESS c52

I. F. Vilvilyams *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 76-79 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 57-60 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The relationship between changes in the pulse blood filling of earlobe vessels and cardiac arrhythmias was studied in 91 manned experiments during which test subjects were exposed to simulated weightlessness and then to acceleration of +3 Gz for 5 min in a 7.25 m arm centrifuge. The vascular type of functional decompensation may transform into the cardiac type in normal men during recovery from an exposure to +3 Gz and simulated weightlessness. S.F.

N81-28713# Joint Publications Research Service, Arlington, Va.

EXTERNAL RESPIRATION IN THE PRESENCE OF HYPERBARIC OXYGENATION c52

V. A. Glazkova and I. N. Chernyakov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 80-84 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 60-64 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The function of external respiration (measured by pneumotachography, spirometry, diffusion perfusion ratios of the lungs) and acid base equilibrium in blood of men exposed to hyperbaric (up to 3 ata) hyperoxia for 5 to 6 hours is discussed. The above parameters remained unaltered. An inference is made that oxygenation can be used in aerospace medicine. Author

N81-28714# Joint Publications Research Service, Arlington, Va.

RESPIRATORY REACTIONS TO CHANGES IN GAS ENVIRONMENT DENSITY AT DIFFERENT RATES OF INSPIRATORY FLOW c52

I. S. Breslav, Ye. L. Kalacheva, E. A. Konza, and N. Z. Klyuyeva *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 85-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 64-67 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The effect of altered gas density on the respiratory function was investigated in relation to the velocity of gas flows in airways. In the normal man breathing of normoxic He-O2 (with a density of 0.34 as compared to air) slightly decreased and inhalation of SF6-O2 (with a density of 4.2) significantly increased the metabolic rate of ventilation. These effects were distinct when inspiratory flows reached threshold values. In anesthesized cats, He-O2 breathin reduced inspiratory activity upon forced respiration, and SF6-O2 breathing increased it upon quiet respiration. These findings are used to predict limiting densities of respiratory mixtures for a normal man performing physical work of a certain load undersea. Author

N81-28715# Joint Publications Research Service, Arlington, Va.

THE TOXIC EFFECT OF INSIGNIFICANT OXYGEN EXCESS IN AN ARTIFICIAL GAS ATMOSPHERE c52

P. M. Gramenitskiy, V. B. Malkin, L. K. Romanova, Ye. V. Loginova, N. A. Roshchina, and K. S. Yurova *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 67-72 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

It was demonstrated that a 24 hour exposure of animals to an artificial atmosphere with PO2 = 250 mm Hg caused lesions in the pulmonary structure which were most distinct in the surfactant system. It was found that after the exposure the animal tolerance to hyperbaric (4 atm) hyperoxic atmosphere was lowered. Author

N81-28716# Joint Publications Research Service, Arlington, Va.

RESULTS OF HEAT TRANSFER-1 EXPERIMENT CONDUCTED ABOARD THE COSMOS-936 BIOSATELLITE c54

L. Novak, L. Prokopova, A. M. Genin, and V. K. Golov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 97-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 180 p 73-76 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The experiment Heat Exchange-1 confirmed the hypothesis about weightlessness-induced significant decrease of heat emission from a heated body into the environment at air ventilation rate near body surface below .1 msec. Author

N81-28717# Joint Publications Research Service, Arlington, Va.

A DEVICE FOR STUDYING THE TURNING REFLEX IN SMALL LABORATORY ANIMALS

G. S. Ayzikov, A. S. Markin, and I. Yu. Sarkisov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 102-104 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 76-78 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

A device was developed to make it possible to immobilize an animal reliably and for a long time in any position (including belly up), and to rapidly release it for a free fall from any initial position, with a nontraumatic landing. The device design and operation are discussed. S.F.

N81-28718# Joint Publications Research Service, Arlington, Va.

EFFECT OF IONIZED AIR ENVIRONMENT ON HUMAN HORMONAL SYSTEMS c52

R. A. Tigranyan, V. P. Savina, N. A. Davydova, and N. F. Kalita *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) p 105-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 78-81 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

A 16 day stay of 4 subjects in a pressure chamber with an ionized air environment elected activation of the hormonal element in the adrenosympathetic (AS) system, increase in functional activity of the hypophysioadrenocortical system and stimulation of Beta-cells of the islets of Langerhans in the pancreas, and at the same time it had an inhibitory effect on the mediator element of the AS and hypophysio - thyroid systems. S.F.

N81-28719# Joint Publications Research Service, Arlington, Va.

STUDY OF MOUSE MORTALITY AFTER EXPOSURE TO HELIUM IONS WITH ADMINISTRATION OF TILORONE

B. S. Fedorenko, M. Ya. Talash, and Yu. D. Parfenov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 110-112 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 81-82 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

A comparative study was made of mortality rate of mice after exposure to helium ions and gamma rays under ordinary conditions and followng preliminary administration of tilorone. Tilorone is an inductor of interferon, which has some effect on development of radiation lesions. The product also has a mild radioproctective action. Preadministration of tilorone did not reliably lower the postradiation death rate after delivery of helium ions in doses of 600, 700 and 800 rad. At the same time, administration of tilorone 18 h before irradiation shortened the animals' life span. It is concluded that preliminary administration of tilorone enhances the radiation lesion from helium ions. We observed greater effectiveness of helium ions, as compared to gamma rays. S.F.

N81-28720# Joint Publications Research Service, Arlington, Va.

SEASONAL CHANGES IN LEUKOCYTE COUNT AND PHAGOCYTIC ACTIVITY OF LEUKOCYTES IN INDIVIDUALS WORKING IN A CLOSED ENVIRONMENT c52

V. S. Novikov and A. M. Timofeyev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 112-114 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmecheskaya Med. (USSR), v. 14, no. 6, 1980 p 82-84 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

A survey was made in the temperate climate zone of 43 operators ranging in age from 19 to 22 years, who worked in sealed-off rooms where ambient temperature ranged from 24 to 42 C and ambient (atmospheric) noise ranged from 87 to 103 dB. The subjects spent 8 h daily under these conditions. The control group (30 people) consisted of subjects in the same occupation, of the same age and with the same work tenure, but who worked under normal hygienic conditions. An increase in leukocyte count was demonstrated in people working in a closed environment, referable to the neutrophils and monocytes in the wintertime, and a reliable decline in the spring and summer. Similar seasonal changes were observed in the control group. There was a lower leukocyte count, due to reduction in number of neutrophils and monocytes, in the experimental group. The eosinophil content was higher in the experimental group at all tested times. S.F.

N81-28721# Joint Publications Research Service, Arlington, Va.

PERCEPTION OF INSTRUMENT DATA AS RELATED TO FLYING EXPERIENCE c53

V. V. Kniga *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 115-119 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 84-86 (For primary document see N81-28699 19-51)

Avail: NTIS HC A07/MF A01

The link was determined between evaluation of quality of perception and processing of instrument data under laboratory conditions and the pilots' experience in instrument flying. S.F.

N81-28722# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 15, NO. 2, MARCH - APRIL 1981

O. G. Gazenko, ed. 8 May 1981 131 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981

(JPRS-78028) Copyright. Avail: NTIS HC A07/MF A01

Biological effects, mainly of weightlessness and rotation in manned space flight, are discussed. Vision, hygiene, air quality, emotional well-being and biomedical training are included. For individual titles, see N81-28723 through N81-28737.

N81-28723# Joint Publications Research Service, Arlington, Va.

THE FIRST MANNED SPACE FLIGHT **c12**

O. G. Gazenko, A. M. Genin, N. N. Gurovskiy, and A. R. Kotovskaya *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 1-4 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 5, no. 2, Mar. - Apr. 1981 p 5-7 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

A summary is made of the experimental steps taken in the U.S.S.R. toward manned space flight, including testing to evaluate the effects of weightlessness on animals and men. Cosmonaut training is described. S.F.

N81-28724# Joint Publications Research Service, Arlington, Va.

BIOMEDICAL TRAINING OF COSMONAUTS (HISTORY, CONTENT, STAGES, EVOLUTION AND TRENDS OF DEVELOPMENT) **c52**

G. F. Khlebnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 5-13 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 8-14 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Changes in the biomedical training of cosmonauts are discussed and the major tendencies of its improvements are described. S.F.

N81-28725# Joint Publications Research Service, Arlington, Va.

PSYCHOPHYSIOLOGICAL SCREENING: STATUS AND PROSPECTS **c53**

N. N. Gurovskiy and M. A. Novikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 14-25 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 15-24 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

The major stages in the development of psychophysiological selection of cosmonauts in the U.S.S.R. are discussed. The psychophysiologicl selection was originally based on the data of psychoneurological expertise of the flight personnel and achievements of aviation psychology in the U.S.S.R. This was followed by the development of psychophysiological research, using instrumentation and simulation flights. Further complication of flight programs and participation of nonpilot cosmonauts (engineers, scientists) necessitated detailed study of personality properties and application of personality tests. At the present stage in development of psychophysiological selection great importance is attached to biorhythmological selection and methods for studying man's capabilities to control his own emotional, behavioral and autonomic reactions as well as environmental parameters. Methods of group selection and problems of rational selection of space crews are discussed. Author

N81-28726# Joint Publications Research Service, Arlington, Va.

PREVENTION OF PSYCHOEMOTIONAL DISTURBANCES DURING LONG-TERM SPACE FLIGHTS BY MEANS OF PSYCHOLOGICAL SUPPORT **c53**

V. I. Myasnikov and O. P. Kozerenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 26-32 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 25-29 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

A number of supportive and rehabilitative measures forming psychological support are used to prevent potential psychoemotional disorders in crewmembers during prolonged space missions. The use of these measures in the Salyut 6 Soyuz 96-185 day space flights has shown their efficiency in terms of expansion of the 'psychological living space' and maintenance of a high emotional and working tone of crewmembers. Author

N81-28727# Joint Publications Research Service, Arlington, Va.

CURRENT STATUS AND PROSPECTS OF HYGIENIC SUPPORT OF MANNED SPACE FLIGHTS **c52**

Yu. G. Nefedov and S. N. Zaloguyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 33-41 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 30-37 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Results of investigations related to the hygienic maintenance of manned space flights are discussed. The major problems in this field that need to be resolved in order to maintain adequate environments in space cabins are reviewed. S.F.

N81-28728# Joint Publications Research Service, Arlington, Va.

OPTIMUM ATMOSPHERE IN PRESSURIZED CABINS AND FUTURE USE THEREOF **c54**

N. A. Agadzhanyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 42-49 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 37-43 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Physiological validation of an artificial atmosphere in manned cabins of flying vehicles remains one of the major biomedical problems. It was experimentally demonstrated that oxygen and carbon dioxide are closely related in vital processes, acting as antagonists or synergists. Changing their content in an enclosure, it is possible to influence the function of the human body and to correct its deconditioning due to prolonged hypokinesia. Active mountain adaptation accompanied by a marked mobilization of physiological systems seems to train and activate functional reserves of the body, making them more adequate to tolerate extreme effects. Author

N81-28729# Joint Publications Research Service, Arlington, Va.

FITNESS OF HUMAN VISION WITH EXPOSURE TO VERY BRIGHT LIGHT **c52**

V. I. Kartsev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 50-60 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med., v. 15, no. 2, Mar. - Apr. 1981 p 44-51 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Publications on visual reactions of man pre-exposed to the deadaptive effects of different light sources are reviewed. S.F.

N81-28730# Joint Publications Research Service, Arlington, Va.

BIOLOGICAL RESEARCH IN SPACE

M. G. Tairbekov and G. P. Parfenov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 61-71 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 51-60 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Investigations carried out during the last two decades on various biological objects - microorganisms, plant seeds, insects, higher and lower plants, fish and amphibians in real and simulation space flights are described. Current knowledge of the biological role of gravity and possible mechanisms of adaptation to weightlessness, as well as the suitability of different biological objects for further space studies, are discussed. Most experiments conducted in real space flights lent support to the theoretical studies of the level and limits of weightlessness effects upon biological systems. Analysis of the data obtained in space and ground bound experiments suggests that molecular processes are indifferent to an altered gravity and that energy metabolism plays an important role in adaptation of biological systems to zero g. S.F.

N81-28731# Joint Publications Research Service, Arlington, Va.

ANIMAL EXPERIMENTS ABOARD BIOSATELLITES OF THE COSMOS SERIES: RESULTS AND PROSPECTS

O. G. Gazenko, Ye. A. Ilin, V. S. Oganov, and L. V. Serova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 72-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 60-66 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Results of animal (rat) experiments carried out onboard biosatellites Cosmos-605-690, 782, 936 and 1129 are presented with emphasis on changes in metabolism and musculoskeletal system. The modifying effect of weightlessness on the animal radiosensitivity is considered. The use of artificial gravity as a countermeasure against adverse effects of weightlessness is discussed. Primate experiments aimed at a detailed study of the mechanisms of weightlessness-induced changes in the structure and function of the cardiovascular, musculoskeletal and vestibular systems are described. Author

N81-28732# Joint Publications Research Service, Arlington, Va.

MORPHOLOGICAL EFFECTS OF WEIGHTLESSNESS AND PATHOGENESIS THEREOF **c52**

A. S. Kaplanskiy and Ye. A. Savina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 81-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 66-72 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Results of morphological and histochemical investigations of rats flown onboard the Soviet biological satellite of the Cosmos series are summarized. The changes in different functional systems and organs were found to be related. Hypotheses concerning the pathogenesis of the changes detected are included. It is emphasized that most changes are induced by a reduction of load upon the musculoskeletal system in weightlessness. S.F.

N81-28733# Joint Publications Research Service, Arlington, Va.

SOVIET RESEARCH ON ARTIFICIAL GRAVITY **c54**

A. R. Kotovskaya, R. R. Galle, and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 90-100 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 72-79 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Biomedical investigations concerning artificial gravity performed so far in the USSR are reviewed. It is believed that the major task is to identify the minimum value of artificial gravity which may eliminate adverse effects of weightlessness on the human body. In ground-based investigations, high priority is given to the development of methods of increasing human tolerance to a rotating environment. Author

N81-28734# Joint Publications Research Service, Arlington, Va.

COSMONAUTICS AND DEVELOPMENT OF AVIATION MEDICINE **c52**

N. M. Rudnyy and A. A. Gyurdzhian *In its* USSR Rept.: Space Biol. and Aerospace Med. Vol. 15, No. 2, 1981 (JPRS-78028) 8 May 1981 p 101-106 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 79-84 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Certain aspects of interaction between aviation and space medicine, contribution of aviation medicine into the development of space biology and medicine, and the role of cosmonautics in current achievements of aviation medicine are discussed. Advances in studies of space flight effects, development of life support and flight safety systems, medical and psychological support of the flight personnel, implementation of methods and techniques, electronics, computers and automatics are included. Particular importance is attached to the rapid development of ergonomic approaches to the design and application of technology, study of psychophysiology and psychology of human efficient activity in the system 'man-flying vehicle-environment,' i.e., psychophysiological ergonomics. Methodological and organizational aspects of the development of aviation and space medicine are briefly described. Author

N81-28735# Joint Publications Research Service, Arlington, Va.

CIRCADIAN BIORHYTHMS AND FLIGHT PLANNING **c52**

A. A. Yurchenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 107-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 84-87 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

It was shown that circadian rhythms of functional systems of the human body exert a noticeable effect on psychophysiology and reliability parameters of pilots and cadets which may be of special importance in flights on a shift basis. The dysbalance in work-rest cycles and circadian biorhythms decreases strongly qualitative and quantitative indices of pilot activities. In some cases this causes erroneous actions, contingent situations and accidents. Author

N81-28736# Joint Publications Research Service, Arlington, Va.

A MODEL OF FORMATION OF NYSTAGMIC REACTIONS TO A SET OF CALORIC TESTS **c52**

M. M. Levashov and Ya. A. Bedrov *In its* USSR Rept.: Space Biol. and Aerospace Med. Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 112-119 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 87-92 (for primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

The model furnishes additional information about the vestibulary system, when evaluating caloric tests. The nystagmus intensity (the slow component rate during maximum intensity) is assumed to be proportional to the difference between energy levels (EL) of the right and left vestibular nuclear complexes (NC). EL of each NC is equal to the afferent flow (AF) plus its inherent activity (IA). During caloric (two warm and two cold) tests IA remains constant. AF at rest is equal to spontaneous activity of receptors and during stimulation it increases or decreases in a linear fashion. Parameters of the model are: difference between intensities of reactions to warm and cold tests, difference between EL of two (right and left) unstimulated NC, and ratio of nystagmus intensity to the stimulus for each labyrinth. S.F.

N81-28737# Joint Publications Research Service, Arlington, Va.

METHOD FOR CONCENTRATING TRACE IMPURITIES FROM THE ATMOSPHERE OF ISOLATED CHAMBERS BY MEANS OF COOLED TRAPS **c54**

T. V. Node, N. M. Vatulya, and O. A. Sukhorukov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 120-123 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 93-94 (For primary document see N81-28722 19-51)

Avail: NTIS HC A07/MF A01

Questions of practical use of traps at low temperature for quantitative chromatographic analysis of trace contaminants present in the atmosphere of inhabited sealed spaces are discussed. S.F.

N81-28738# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences.

MODEL MANAGEMENT SYSTEMS: AN APPROACH TO DECISION SUPPORT IN COMPLEX ORGANIZATIONS

Joyce J. Elam, John C. Henderson, and Louis W. Miller 4 Aug. 1980 41 p refs

(Contract N00014-75-C-0440)

(AD-A089339) Avail: NTIS HC A03/MF A01 CSCL 05/1

A system designed to extend the traditional decision support system (DSS) concept to support the model management requirements of complex organizations is described. The system's objectives are to provide a mechanism to represent and to diffuse the organization knowledge about models so that the user community can utilize this knowledge to adapt or build decision aids. E.A.K.

N81-28739*# California Univ., Berkeley. Lawrence Berkeley Lab.

EFFECTS ON BIOLOGICAL SYSTEMS OF REFLECTED LIGHT FROM A SATELLITE POWER SYSTEM

M. White Apr. 1981 55 p refs

(Contract W-7405-eng-48)

(NASA-CR-164586; DOE/ER-0100) Avail: NTIS HC A04/MF A01 CSCL 06C

Light reflection produced by the satellite power system and the possible effects of that light on the human eye, plants, and animals were studied. For the human eye, two cases of reflected light, might cause eye damage if viewed for too long. These cases are: (1) if, while in low Earth orbit, the orbital transfer vehicle is misaligned to reflect the Sun to Earth there exists a maximum safe fixation time for the naked eye of 42.4 secs; (2) reflection from the aluminum paint on the back of the orbital transfer vehicle, while in or near low Earth orbit, can be safely viewed by the naked eye for 129 sec. For plants and animals the intensity and timing of light are not a major problem. Ways for reducing and/or eliminating the irradiances are proposed. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-28740* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

URINE COLLECTION APPARATUS

Roger B. Michaud, inventor (to NASA) (Martin Marietta Aerospace, Denver) 2 Jun. 1981 8 p Filed 27 Apr. 1979 Supersedes N79-23657 (17 - 14, p 1887) Sponsored by NASA

(NASA-Case-MSC-18381-1; US-Patent-4,270,539; US-Patent-Appl-SN-034531; US-Patent-Class-128-295; US-Patent-Class-4-144.3) Avail: US Patent and Trademark Office CSCL 06B

A urine collection device for females comprises an interface body with an interface surface for engagement with the user's body. The interface body comprises a forward portion defining a urine-receiving bore which has an inlet in the interface surface adapted to be disposed in surrounding relation to the urethral opening of the user. The interface body also has a rear portion integrally adjoining the forward portion and a non-invasive vaginal seal on the interface surface for sealing the vagina of the user from communication with the urine-receiving bore. An absorbent pad is removably supported on the interface body and extends laterally therefrom. A garment for supporting the urine collection is also disclosed.

Official Gazette of the U.S. Patent and Trademark Office

N81-28741 British Library Lending Div., Boston Spa (England).

IMPAIRMENT OF PERFORMANCE BY ALCOHOL AND DIAZEPAM

J. Lutze Feb. 1981 17 p refs Transl. into ENGLISH from Zetischrift fuer Rechtsmedizin (West Germany), v. 82, no. 4, 179 p 327-336

(BLL-RTS-12193)

The effect of the intake of diazepam and alcohol on simple performance tests was investigated. The combined administration of diazepam and alcohol led to an increase of the plasma diazepam concentration as compared to that obtained after diazepam without alcohol. Furthermore, after combined intake of diazepam and alcohol a decrease of performance was observed, that uses significantly higher, than the effects obtained after either alcohol or diazepam alone. The impairment uses especially noticeable during the first hour of the experiment, i.e., until the plateau of the diazepam plasma concentration and impairment of performance could not be established. E.A.K.

N81-28742 Princeton Univ., N. J.

ELECTRONIC SPIN TUNNELING IN THE BINDING OF CARBON MONOXIDE TO HEMOGLOBIN Ph.D. Thesis

Bernard Scott Gerstman 1981 174 p

Avail: Univ. Microfilms Order No. 8114619

A nondiabatic quantum tunneling process, a mechanism for effecting the electronic spin change of the hemoglobin's iron upon the binding of carbon monoxide was investigated. The Born-Oppenheimer approximation is used to separate the recombination of the CO to the iron in the heme at low temperatures into a nuclear tunneling and an electronic tunneling. The crystal field of the heme determines the L-quantization axis in each local heme coordinate system. Hemoglobin has a strong absorption band at 436 nm when CO is bound. This absorption is orientation dependent for the absorption is predominantly for light polarized in the place, of the dish-like heme inside the hemoglobin molecule. The CO molecules bound to hemoglobin molecules in a sample are photodissociated by an intense laser pulse in the presence of a magnetic field. As the CO molecules recombine with the hemoglobin the optical dichroism of the sample is monitored. Theory behind the magnetic field dependence is investigated and results of a magnetic field dependence to the recombination rate are presented. Dissert. Abstr.

N81-28743# Cornell Univ., Ithaca, N. Y. College of Agriculture and Life Sciences.

INSTRUMENTATION AND SOFTWARE FOR THE COLLECTION, ANALYSIS, AND INTERPRETATION OF EYE MOVEMENT DATA DURING READING Technical Report, 1 Mar. 1980 - 31 May 1981

Rafael Hirschfeld and George Bieger Jun. 1981 27 p refs

(Contract N00014-80-C-0372; RR0420602)

(AD-A100495; RR-4-SER-B; TR-3) Avail: NTIS HC A03/MF A01 CSCL 05/10

This report describes a method and apparatus for collecting and interpreting eye movement data, for research on reading pictures as well as text, that is both relatively inexpensive and portable. The report lists and describes hardware and software components of a data collection and data analysis system which provides precise information regarding the location, duration, and sequence of eye fixations during the reading of materials that are composed of both text and pictures. A procedure for collecting eye-movement data in non-laboratory settings such as classrooms is also described. Author (GRA)

N81-28744# Wisconsin Univ. - Madison. Mathematics Research Center.

LOCAL EXISTENCE FOR THE CAUCHY PROBLEM OF A REACTION-DIFFUSION SYSTEM WITH DISCONTINUOUS NONLINEARITY Technical Summary Report

David Terman May 1981 27 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-80-17158)

(AD-A100564; MRC-TSR-2221) Avail: NTIS HC A03/MF A01 CSCL 12/1

The most famous model for nerve conduction is due to Hodgkin and Huxley. However, a mathematical analysis of their model has proven very difficult. The complexity of the Hodgkin and Huxley model has led a number of other authors to introduce simpler models. In this report, we consider one such simplification. It has been demonstrated (experimentally) that impulses in the nerve axon travel with constant shape and velocity. Mathematically, this corresponds to traveling wave solutions. A number

of authors have proven that the mathematical equations considered here do possess traveling wave solutions. Another property of impulses in the nerve axon is the existence of a threshold phenomenon. This corresponds to the biological fact that a minimum stimulus is needed to trigger an impulse. Here we prove some preliminary results which will be used in a later report when it is demonstrated that the equations under study do indeed exhibit a threshold phenomenon. GRA

N81-28745# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PROGRAMMED CONTROL OF OPTICAL GRATING SCALES FOR VISUAL RESEARCH M.S. Thesis
Kenneth L. Martindale Dec. 1980 61 p refs
(AD-A100792; AFIT/GE/EE/80D-29) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report documents the design of a microprocessor based device which controls the brightness and contrast levels of video signals to be used by scientists in vision research to control laboratory monitors. Contrast control in a standard CRT monitor is obtained through the use of a commercial video chip linear circuit, and brightness control via a straight forward transistor amplifier. The transistor is inserted into the monitor's existing manual control circuit. The linear circuit and transistor are regulated by the microprocessor through digital-to-analog converters. A feedback network reports the actual brightness and contrast produced on the monitor's screen. This network is comprised of a 1024 element photodiode array and an analog-to-digital converter. The photodiode array measures the luminance directly off the monitor and the analog-to-digital converter digitizes the information for use by the microprocessor. The report also contains the results of an investigation into the use of digitally generated video and color monitors for vision research. GRA

N81-28746# Rochester Univ., N. Y. Div. of Toxicology.
URINARY METALLOTHIONEIN AS A BIOLOGICAL INDICATOR OF OCCUPATIONAL CADMIUM EXPOSURE
Chiharu Tohyama, Zahir A. Shaikh, Kenneth J. Ellis (Brookhaven National Lab.), and Stanton H. Cohn (Brookhaven National Lab.) 1981 9 p refs Presented at 3rd Intern. Cadium Conf., Miami, Fla., 3 Feb. 1981 Sponsored in part by International Lead Zinc Research Organization
(Contract DE-AC02-76CH-00016; Grants NIEHS-ES01247; NIEHS-ES01248)
(BNL-29064; CONF-810238-1) Avail: NTIS HC A02/MF A01

Radioimmunoassay and neutron activation data indicate that the urinary metallothionein concentration is related to the liver Cd concentration in occupational Cd exposure. It is also related to the kidney Cd content, but only before the onset of renal dysfunction. A dose-response relationship, may be useful in minimizing the hazard of Cd-induced renal dysfunction. DOE

N81-28747# Florida State Univ., Tallahassee.
DAMAGING EFFECTS OF VISIBLE LIGHT. COMPREHENSIVE REPORT Progress Report
1981 26 p refs
(Contract DE-AS05-78OR-06021)
(DOE/OR-06021/T1) Avail: NTIS HC A03/MF A01

Retinal light damage was studied. A myriad of variables effect the production of light damage. These include age, prior light history, body temperature, vitamin A status, intensity, wavelength and duration of light. The intensity-duration function and the age function were studied in detail in rats. DOE

N81-28700# Joint Publications Research Service, Arlington, Va.
MAXIMUM OXYGEN UPTAKE AS A CRITERION OF HUMAN RESISTANCE TO HYPOXIA, HYPERTHERMIA AND HYPOTHERMIA
A. M. Vasilenko *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 1-10 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 3-10 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28701# Joint Publications Research Service, Arlington, Va.
STUDY OF HEMODYNAMICS AND PHASE STRUCTURE OF CARDIAC CYCLE IN SECOND CREW OF THE SALYUT-6 ORBITAL STATION AT REST
A. D. Yegorov, O. G. Itsekhovskiy, I. I. Kasya, I. V. Alferova, A. P. Polyakova, V. F. Turchaninova, V. I. Bernadskiy, V. G. Doroshev, and Ye. A. Kobzev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 11-15 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmiheskaya Med. (USSR), v. 14, no. 6, 1980 p 10-14 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28702# Joint Publications Research Service, Arlington, Va.
CHANGES IN HEMOGLOBIN MASS DURING REAL AND SIMULATED SPACE FLIGHTS
I. S. Balakhovskiy, V. I. Legenkov, and R. K. Kiselev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 16-23 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 14-20 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28703# Joint Publications Research Service, Arlington, Va.
THEORETICAL LEFT VENTRICULAR EJECTION PERIOD IN WEIGHTLESSNESS
V. A. Degtyarev, N. A. Lapshina, and L. Ya. Andriyako *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 24-28 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 20-23 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28704# Joint Publications Research Service, Arlington, Va.
SLEEP DISTINCTIONS, CIRCADIAN RHYTHM OF PHYSIOLOGICAL FUNCTIONS AND EFFICIENCY OF MAN ON FIRST DAY AFTER SHIFT IN SLEEPING-WAKING CYCLE
A. N. Litsov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 29-35 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 23-28 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28705# Joint Publications Research Service, Arlington, Va.
HISTAMINE AND SEROTONIN LEVELS IN MAN IN THE PRESENCE OF NERVOUS-EMOTIONAL STRESS
S. Kalandarov, I. D. Frenkel, and L. I. Nekrasova *In its* USSR Rept.: Space Biol. and Areospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 36-40 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no 6, 1980 p 29-32 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28706# Joint Publications Research Service, Arlington, Va.
MOTOR ACTIVITY OF MAN WHEN IT IS ARTIFICIALLY RESTRICTED
N. Ye. Panferova and V. I. Pervushin *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 41-44 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 32-35 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28709# Joint Publications Research Service, Arlington, Va.
COMPARATIVE EFFICACY OF VARIOUS BIOLOGICALLY ACTIVE COMPOUNDS DURING EXERCISE
V. S. Shashkov and N. G. Lakota *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 57-65 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 44-51

(For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28712# Joint Publications Research Service, Arlington, Va.
RELATIONSHIP BETWEEN PULSED FILLING OF EARLOBE VESSELS AND CARDIAC EXTRASYSTOLE DURING HEAD-PELVIS ACCELERATIONS AFTER EXPOSURE TO SIMULATED WEIGHTLESSNESS
I. F. Vilvilyams *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 76-79 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 57-60 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28713# Joint Publications Research Service, Arlington, Va.
EXTERNAL RESPIRATION IN THE PRESENCE OF HYPERBARIC OXYGENATION
V. A. Glazkova and I. N. Chernyakov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 80-84 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 60-64 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28714# Joint Publications Research Service, Arlington, Va.
RESPIRATORY REACTIONS TO CHANGES IN GAS ENVIRONMENT DENSITY AT DIFFERENT RATES OF INSPIRATORY FLOW
I. S. Breslav, Ye. L. Kalacheva, E. A. Konza, and N. Z. Klyuyeva *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 85-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 64-67 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28715# Joint Publications Research Service, Arlington, Va.
THE TOXIC EFFECT OF INSIGNIFICANT OXYGEN EXCESS IN AN ARTIFICIAL GAS ATMOSPHERE
P. M. Gramenitskiy, V. B. Malkin, L. K. Romanova, Ye. V. Loginova, N. A. Roshchina, and K. S. Yurova *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 90-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 67-72 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28718# Joint Publications Research Service, Arlington, Va.
EFFECT OF IONIZED AIR ENVIRONMENT ON HUMAN HORMONAL SYSTEMS
R. A. Tigranyan, V. P. Savina, N. A. Davydova, and N. F. Kalita *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) p 105-109 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 78-81 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28720# Joint Publications Research Service, Arlington, Va.
SEASONAL CHANGES IN LEUKOCYTE COUNT AND PHAGOCYTIC ACTIVITY OF LEUKOCYTES IN INDIVIDUALS WORKING IN A CLOSED ENVIRONMENT
V. S. Novikov and A. M. Timofeyev *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 112-114 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmecheskaya Med. (USSR), v. 14, no. 6, 1980 p 82-84 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28724# Joint Publications Research Service, Arlington, Va.
BIOMEDICAL TRAINING OF COSMONAUTS (HISTORY, CONTENT, STAGES, EVOLUTION AND TRENDS OF DEVELOPMENT)
G. F. Khlebnikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 5-13 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 8-14 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28727# Joint Publications Research Service, Arlington, Va.
CURRENT STATUS AND PROSPECTS OF HYGIENIC SUPPORT OF MANNED SPACE FLIGHTS
Yu. G. Nefedov and S. N. Zaloguyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 33-41 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 30-37 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28729# Joint Publications Research Service, Arlington, Va.
FITNESS OF HUMAN VISION WITH EXPOSURE TO VERY BRIGHT LIGHT
V. I. Kartsev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 50-60 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med., v. 15, no. 2, Mar. - Apr. 1981 p 44-51 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28732# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL EFFECTS OF WEIGHTLESSNESS AND PATHOGENESIS THEREOF
A. S. Kaplanskiy and Ye. A. Savina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 81-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 66-72 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28734# Joint Publications Research Service, Arlington, Va.
COSMONAUTICS AND DEVELOPMENT OF AVIATION MEDICINE
N. M. Rudnyy and A. A. Gyurdzhian *In its* USSR Rept.: Space Biol. and Aerospace Med. Vol. 15, No. 2, 1981 (JPRS-78028) 8 May 1981 p 101-106 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 79-84 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28735# Joint Publications Research Service, Arlington, Va.
CIRCADIAN BIORHYTHMS AND FLIGHT PLANNING
A. A. Yurchenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 107-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 84-87 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28736# Joint Publications Research Service, Arlington, Va.
A MODEL OF FORMATION OF NYSTAGMIC REACTIONS TO A SET OF CALORIC TESTS
M. M. Levashov and Ya. A. Bedrov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 112-119 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 87-92 (for primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-28748*# Brandeis Univ., Waltham, Mass. Dept. of Psychology.
VESTIBULAR SELECTION CRITERIA DEVELOPMENT Quarterly Progress Report, 1 Jun. 1980 - 1 Apr. 1981
James R. Lackner 1 Jun. 1981 11 p refs
(Contract NAS9-15147)
(NASA-CR-161044) Avail: NTIS HC A02/MF A01 CSCL 05J

The experimental elicitation of motion sickness using a short arm centrifuge or a rotating chair surrounded by a striped cylindrical enclosure failed to reveal any systematic group or consistent individual relationship between changes in heart rate, blood pressure, and body temperature and the appearance of symptoms of motion sickness. A study of the influence of vision on susceptability to motion sickness during sudden stop simulation shows that having the eyes open during any part of the sudden stop assessment is more stressful than having them closed throughout the test. Subjects were found to be highly susceptible to motion sickness when tested in free fall and in high force phases of flight. The effect of touch and pressure cues on body orientation during rotation and in parabolic flight are considered as sensory as well as motor adaptation. A.R.H.

N81-28749# Air Command and Staff Coll., Maxwell AFB, Ala.
NEW TRAINING REALISM FOR B-52 CREWS
Bruce E. Eickhoff May 1981 25 p refs
(AD-A100571; ACSC-0780-81) Avail: NTIS HC A02/MF A01 CSCL 05/9

Increasing defensive capabilities of potential enemies have required significant changes in the Strategic Air Command's mission and training philosophy since the mid-1970s. Specifically, the command has stepped up B-52 participation in a variety of exercises to improve readiness in both the nuclear and non-nuclear missions. The article discusses the SAC training program in some detail to show how changes in philosophy insure that the aging B-52 will be a viable weapon system during the 1980s. GRA

N81-28721# Joint Publications Research Service, Arlington, Va.
PERCEPTION OF INSTRUMENT DATA AS RELATED TO FLYING EXPERIENCE
V. V. Kniga *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 115-119 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 1980 p 84-86 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28725# Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL SCREENING: STATUS AND PROSPECTS
N. N. Gurovskiy and M. A. Novikov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 14-25 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 15-24 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28726# Joint Publications Research Service, Arlington, Va.
PREVENTION OF PSYCHOEMOTIONAL DISTURBANCES DURING LONG-TERM SPACE FLIGHTS BY MEANS OF PSYCHOLOGICAL SUPPORT
V. I. Myasnikov and O. P. Kozerenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 26-32 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 25-29 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-28750*# Georgia Inst. of Tech., Atlanta. School of Textile Engineering.
DEVELOPMENT OF MOLDED, COATED FABRIC JOINTS: FABRIC CONSTRUCTION CRITERIA FOR A SPACESUIT ELBOW JOINT Status Report, period ending Aug. 1981
L. Howard Olson Aug. 1981 19 p refs
(Grant NsG-2356)
(NASA-CR-164629) Avail: NTIS HC A02/MF A01 CSCL 06K

The design and fabrication of a molded, coated fabric elbow joint capable of operating reliably at 8 psi internal pressure for extended periods of flexure is considered. The overall design of the joint includes: (1) selection of heatsettable fiber of sufficient strengths; (2) choosing an optimum fabric construction; (3) a fatigue resistant; flexible coating; and (4) a molding technique. A polyester yarn of type 56 Dacron and a urethane coating system were selected. The relationships between yarn and weave parameters which lead to an optimum fabric construction for the 8 psi elbow joint are defined. A.R.H.

N81-28751# Human Engineering Labs., Aberdeen Proving Ground, Md.
AN INVESTIGATION OF THE EFFECTS OF THE DH-132 HELMET SUSPENSION SYSTEM UPON PERCEIVED HELMET WEIGHT UNDER STATIC CONDUCTIONS Final Report
R. Bradley Randall Apr. 1981 12 p refs
(AD-A100392; HEL-TN-3-81) Avail: NTIS HC A02/MF A01 CSCL 05/5

The effects of the Standard 'A' DH-132 Combat Vehicle Crewmember (CVC) helmet suspension system upon perceived helmet weight were investigated. Twenty-three test participants were used in the experiment which evaluated their ability to judge helmet weight relative to a 62-ounce standard over a range of 42 through 82 ounces. A relatively narrow range of indecision--reference weight plus and minus 6-1/4 ounces--indicated that the CVC type of helmet suspension system made the wearer sensitive to relatively minor changes in helmet weight. Author (GRA)

N81-28752# Technology Service Corp., Santa Monica, Calif.
MULTISTATION VOICE DATA ENTRY CONFIGURATION STUDY Final Technical Report, Jan. - Oct. 180
Peter W. Gregory and J. Michael Reaves Apr. 1981 144 p refs
(Contract F30602-80-C-0033; AF Proj. 4303)
(AD-A100470; TSC-PD-B662-1; RADC-TR-81-50) Avail: NTIS HC A07/MF A01 CSCL 05/8

This report describes a study to configure a multiple-station voice data entry (VDE) system for application to the Digital Landmass System (DLMS) data base at the Defense Mapping Agency's Aerospace Center (DMAAC) in St. Louis, Missouri. Study results are based on a thorough analysis of the DLMS data entry process and the analysts' environment, including a detailed questionnaire completed by over 80 analysts. Available equipment for voice data entry and response was surveyed extensively and tabulated results are presented. An operational scenario for VDE is developed, following a detailed functional description of DLMS data entry requirements. Both highly centralized and fully distributed configurations meet system requirements. Interactive, on-line data entry by keyboard is due to be implemented at DMAAC with IFASS (Interactive Feature Analysis Support System). This and other advanced systems being actively sought by DMA will substantially change the analysts' data entry procedures. We therefore recommend that VDE be reevaluated with respect to specific hardware cost/performance

trade-offs after IFASS is implemented and in light of the rapid advancements being made in speech recognition and voice response technology. GRA

N81-28753# Littlé (Arthur D.), Inc., Cambridge, Mass.
A 10-ZONE THERMAL MANIKIN FOR EVALUATION PERSONNEL PROTECTIVE GARMENTS IN COLD AIR AND WATER IMMERSION ENVIRONMENTS Final Report
David L. Richardson and Norman F. Audet Natick, Mass. Navy Clothing and Textile Research Facility Apr. 1981 14 p refs Presented at the Ann. Winter Meeting of ASME, Chicago, 16-21 Nov. 1980
(Contract N00140-79-C-6017)
(AD-A100397; NCTRF-TR-142; NCTRF-7-80) Avail: NTIS HC A02/MF A01 CSCL 14/2

A thermal manikin with the dimensions and weight of a fiftieth percentile standing man simulates metabolic heat and will be used for evaluating the thermal protection capability of clothing and diving suits in cold air and/or water environments. The manikin has 10 independently heated and controlled sections made from aluminum castings. Power for each section is controlled by the temperature level of the torso and by temperature differences between adjacent sections. The manikin is water tight at a depth of 3m without internal pressurization. A pressure equalization system permits evaluation of protective clothing in water environments equivalent to submersion in 300 m of sea water. An automatic control and data acquisition system computes individual temperatures from thermistor sensors, average section temperatures, section and total power, and both section and total insulation (in units of clo) of the garment being tested. Author (GRA)

N81-28754# Naval Ocean Systems Center, San Diego, Calif.
REMOTE OPERATOR PERFORMANCE USING BANDWIDTH-LIMITED TV DISPLAYS: A REVIEW AND PROPOSAL Technical Document, Jan. - Aug. 1980
R. E. Cole (Hawaii Univ.) and B. H. Kishimoto Aug. 1980 21 p refs
(AD-A100438; NOSC/TD-379) Avail: NTIS HC A02/MF A01 CSCL 05/8

This report is part of the overall effort to improve remote operator performance in a work and recovery system by optimizing the viewing system. It features (1) a detailed analysis of remote viewing systems and the problems encountered in their assessment; (2) a literature review of the effect of viewing systems limitations on remote vehicle operation, including limited bandwidth, number of cameras and time delay; and (3) a proposed set of experiments to determine the effects on operator performance of three bandwidth compression variables applied either singly or in combination with the operator selecting the levels that maximize performance. Author (GRA)

N81-28716# Joint Publications Research Service, Arlington, Va.
RESULTS OF HEAT TRANSFER-1 EXPERIMENT CONDUCTED ABOARD THE COSMOS-936 BIOSATELLITE
L. Novak, L. Prokopova, A. M. Genin, and V. K. Golov *In its* USSR Rept.: Space Biol. and Aerospace Med., V. 14, No. 6 (JPRS-77311) 4 Feb. 1981 p 97-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmicheskaya Med. (USSR), v. 14, no. 6, 180 p 73-76 (For primary document see N81-28699 19-51)
Avail: NTIS HC A07/MF A01

N81-28728# Joint Publications Research Service, Arlington, Va.
OPTIMUM ATMOSPHERE IN PRESSURIZED CABINS AND FUTURE USE THEREOF
N. A. Agadzhanyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 42-49 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 37-43 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28733# Joint Publications Research Service, Arlington, Va.
SOVIET RESEARCH ON ARTIFICIAL GRAVITY
A. R. Kotovskaya, R. R. Galle, and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 90-100 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 72-79 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

N81-28737# Joint Publications Research Service, Arlington, Va.
METHOD FOR CONCENTRATING TRACE IMPURITIES FROM THE ATMOSPHERE OF ISOLATED CHAMBERS BY MEANS OF COOLED TRAPS
T. V. Node, N. M. Vatulya, and O. A. Sukhorukov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 2, Mar. - Apr. 1981 (JPRS-78028) 8 May 1981 p 120-123 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 15, no. 2, Mar. - Apr. 1981 p 93-94 (For primary document see N81-28722 19-51)
Avail: NTIS HC A07/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N81-28755 British Library Lending Div., Boston Spa (England).
MULTIPROCESSOR ARCHITECTURES
Tran Van Khai Aug. 1980 27 p refs Transl. into ENGLISH from Rev. Tech. Thomson-CSF (France), v. 2, no. 2, Jun. 1979 p 303-326
(BLL-Trans-3844-(7737.47)) Avail: British Library Lending Div., Boston Spa, England

A multiprocessor architecture, an assembly of physical processors operating under a single integrated control and sharing common resources, is discussed. The multiprocessor architecture is characterized by the following points: it includes several physical processors; the physical processors share common resources (memory, input and output equipment, communication route; they are dependent on a single control system, integrated into the architecture. Starting from a taxonomy of classical interconnection patterns, the most important problems encountered in the design of multiprocessor structures are examined. E.A.K.

N81-28756 California Univ., Berkeley.
RELIABILITY CONSIDERATIONS FOR MASS STORAGE SUBSYSTEMS Ph.D. Thesis
Rooshabh Pratap Varaiya 1980 192 p
Avail: Univ. Microfilms Order No. 8112931

The effective use of error-correcting codes to combat burst

errors in disc storage is described. Other errors which are equally important are control or operational errors. These errors may also be due to electrical noise or due to component malfunctions. Hardware failures due to fluctuations in a system's operating environment may occasionally obtain improper execution of control algorithms or programs resulting in catastrophic or unrecoverable errors. A general protocol is presented that enables the combined transfer of data and control information protected by standard error-detecting codes assuring the faithful communication of such information. Periodic self-diagnosis methods are presented in mass storage subsystems. Techniques are also presented that make effective use of error-correcting and detecting codes in providing concurrent diagnosis and on-line validation of algorithm execution. Dissert. Abstr.

N81-28757 California Univ., Los Angeles.
REQUIREMENTS DEFINITION AND ITS INTERFACE TO THE SARA DESIGN METHODOLOGY FOR COMPUTER-BASED SYSTEMS Ph.D. Thesis
James William Winchester, Jr. 1980 551 p
Avail: Univ. Microfilms Order No. 8113888

A requirements definition subsystem for the System Architects Apprentice (SARA) is developed. A requirements definition language (RDL) is defined to support a computer-based information processing system semantic model (CIPSSM) and a requirements specification model (RSM). The CIPSSM consists of six primitives that can be combined to model (in graphics notation as well as RDL statements) the structural and behavioral components of a CIPS. The RSM defines how primitives can be combined to represent four overlapping structural and behavioral views of a CIPS. When combined, these views yield the complete description of the function, process, and attribute requirements of the CIPS. SARA structural and behavioral models can also be derived from the CIPSSM, allowing the verification and simulation tools of SARA to be used in analyzing the CIPS. A set of analysis checks against elements of information in the RSM are defined. Procedures are described to serve as a guideline in using the language and analysis checks to construct and decompose a specification. Dissert. Abstr.

N81-28758 Syracuse Univ., N. Y.
GENERALIZED METHODS FOR HARDWARE DESCRIPTION Ph.D. Thesis
Surrendra Amul Dudani 1980 393 p
Avail: Univ. Microfilms Order No. 8114163

The design of hardware description languages is considered with the view to represent behavioral and structural properties of a system in one unified description. A set of requirements is formulated which establish the goals for the language design. Based on this criteria, three areas of a language are identified which require further development. These are abstractions for an element, abstractions for a value, and timing specifications. In each of these areas, either prevalent concepts are extended or new facilities are proposed. Finally, algorithms are presented for the implementation of a simulator which is capable of simulating the proposed facilities. Dissert. Abstr.

N81-28759# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EMMAC: A COMPUTER AIDED MICROCONTROL MEMORY EMULATOR
Marcos Antonio Cardoso Cruz and Paulo Farias Santos Amaral May 1981 13 p refs Proposed for presentation at the Intern. Conf. on CAD/CAM, Sao Paulo, Brazil, 21-23 Oct. 1981
(INPE-2050-RPE/299) Avail: NTIS HC A02/MF A01

A microprogramming support system composed by a special interface and a monitor program is described. The Emulator System allows the user to load, test, modify and debug a microprogram in a real time environment, during design phase of a microprogrammed device without PROM burning. It can also aid in the diagnosis and maintenance of the final prototype. The EMMAC is a computer aided design tool. S.F.

N81-28760# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
MICROPROCESSOR CONTROLLED PULSE AMPLITUDE MODULATION DECOMMUTATOR Scientific Interim Report
Kenneth R. Walker and Jack R. Griffin 28 Oct. 1980 40 p refs
(AF Proj. 7659)
(AD-A100270; AFGL-TR-80-0335; AFGL-IP-295) Avail: NTIS HC A03/MF A01 CSCL 09/6

This report describes the design of a microprocessor-controlled pulse amplitude modulation decommutator. The microprocessor hardware design and software routines are covered in detail. The decommutation technique provides flexibility in output formatting such as: (1) visual display of decommutated data reduced to engineering units with labels, flags, and time; (2) a printer output for hard copy of visual display; (3) analog signal outputs for strip chart recording. Author (GRA)

N81-28761# Naval Research Lab., Washington, D. C.
ADDITIVE AND MULTIPLICATIVE DISTORTION SIMULATOR FOR NONREAL TIME TESTING OF HF MODEMS Interim Report
W. M. Jewett and R. Cole, Jr. 11 Jun. 1981 53 p refs
(X0736-CC)
(AD-A100389; NRL-MR-4532) Avail: NTIS HC A04/MF A01 CSCL 17/2

A non-real time FORTRAN program has been developed to provide a simple, standardized means of applying uniform tests to various HF modem signals. The program stresses the modem signal in the same manner as would be experienced by operation on fading channels with tonal interference. Provisions are made for inserting varous transmission filters and for operational scenarios that stress the Doppler acquisition and tracking capabilities of a modem. GRA

N81-28762# Naval Surface Weapons Center, Dahlgren, Va.
EMULATION AID SYSTEM 2 (EASY 2) SYSTEM PROGRAMMER'S GUIDE Final Report
Charles J. Naples, ed. Mar. 1981 212 p refs
(AD-A100522; NSWC/TR-81-98) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report is a system programmer's guide for the Emulation Aid System 2 (EASY 2). EASY 2 is an operating system/virtual machine monitor that runs on the Nanodata QM-1 microprogrammable computer. EASY 2 provides integrated support for: (1) Interactive control of multiple concurrently resident emulations each run in a stand-alone manner; (2) Interactive control of networks of emulations involving communication and synchronization among processors; (3) Virtual, as well as real input/output of emulators to various real peripherals; and (4) Diagnostic displays for debugging of both the emulations and software running on the emulated computers. Author (GRA)

N81-28763# Maryland Univ., College Park. Dept. of Computer Science.
DESIGN OF THE VAX INSTRUMENTATION PACKAGE (VIP) Interim Report
Lawrence W. Dowdy, W. S. Freeze, B. G. Labaw, and J. N. Reed Oct. 1980 19 p refs
(Grant AF-AFOSR-3654-78; AF Proj. 2304)
(AD-A100129; TR-952; AFOSR-81-0481TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the design of the VAX Instrumentation Package (VIP). The target machine initially is the VAX 11/780 running under the Unix operating system at the Computer Science Department of the University of Maryland. VIP is a software monitor of VAX performance. It is designed as an aid for system monitoring, system tuning, and system modeling. For example, VIP monitors the request rate of system files. If the request rate of a particular file becomes high, the system may be 'tuned' by making the file resident in main memory. Specific parameters of the file (e.g., the average number of words transferred per file request) may be used in a queueing network model of the system to predict the performance impact of making the file resident in main memory. A major motivation for VIP is collecting parametric values for, and providing validation of, system models of the VAX. In the past few years, sophisticated and powerful modeling techniques have been developed. A major problem in the application of these techniques is that actual systems do not monitor those input parameters that are necessary for the application of the modeling techniques. Furthermore, these modeling techniques typically provide performance measures

which are more extensive than are usually measured. Validation, as well as the construction of accurate models, is thus a difficult problem. GRA

N81-28764# Maryland Univ., College Park. Dept. of Computer Science.
A FRAMEWORK FOR COMPUTER ARCHITECTURE Interim Report
Cornelia A. Persy, Lee N. Danner, and Ashok K. Agrawala Dec. 1980 38 p refs
(Grant AF-AFOSR-3654-78)
(AD-A100180; TR-974; AFOSR-81-0486TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper presents a framework for computer architecture which is based on the principle function of a computer to perform a mapping from some input into an output. A set of recursive functions is developed to represent computer architecture at any desired level of detail. The definitions are insensitive to whether the functions are realized in software, hardware or firmware. The approach is illustrated using examples. Author (GRA)

N81-28765# Maryland Univ., College Park. Dept. of Computer Science.
RESEARCH ON THE EVALUATION OF COMPUTER SYSTEM ARCHITECTURES Interim Scientific Report, 31 Jan. 1980 - 1 Jan. 1981
Ashok K. Agrawala Feb. 1981 34 p refs
(Grant AF-AFOSR-3654-78; AF Proj. 2304)
(AD-A100201; AFOSR-81-0483TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This interim scientific report presents a synopsis of on-going research sponsored by the AFOSR in the field of the evaluation of computer system architectures. There are many aspects of the problem of the evaluation of computer system architectures. As new technology evolves in hardware and software more complex systems are designed, implemented and used. Such changes in the architecture of computer systems require new evaluation techniques and methodologies. Our research efforts are aimed in this direction. In this report we present a brief discussion of the studies we have undertaken several aspects of this problem. Author (GRA)

N81-28766# Northwestern Univ., Evanston, Ill. School of Electrical Engineering.
DESIGN OF MULTIPROCESSOR STRUCTURES FOR SIMULATION OF POWER-SYSTEM DYNAMICS Final Report
F. M. Brasch, Jr., J. W. VanNess, and S. C. Kang Mar. 1981 103 p refs Sponsored by Electrical Power Research Inst.
(EPRI Proj. 1355-1)
(EPRI-EL-1756) Avail: NTIS HC A06/MF A01

A network of computers arranged in a modified ring structure was designed for solving in parallel the equations describing dynamic disturbances on large power systems. The operations of this network when solving a 1723-bus, 398-generator system using an algorithm based on the Transient Stability Program was simulated on a CDC 6600. The purpose of the simulation was to determine how efficiently the algorithm can be executed in parallel on this multiprocessor configuration. The critical part of this algorithm is the forward and back substitution passes through the LDU decomposed I = Y E equations. A scheduling algorithm that assigns tasks to the processors taking into account the precedence relationships necessary in the solution, the communication requirements, and the loadings on the individual processors was developed to minimize the computing time for this part of the solution. DOE

N81-28767# California Univ., Livermore. Lawrence Livermore Lab. Computer Research Group.
INFLUENCE OF COMPUTER ARCHITECTURES ON NUMERICAL ALGORITHMS
Garry Rodrigue 31 Mar. 1981 56 p refs Presented at Workshop on High Speed Computing, Gleneden Beach, Oreg., 31 Mar 1981 Submitted for publication
(UCRL-85679; CONF-810334-3) Avail: NTIS HC A04/MF A01

Areas that affect numerical algorithms, how these areas affect numerical algorithms, examples of how computers have influenced numerical algorithms in both the past and the present, and some of the difficulties in developing numerical algorithms are discussed. Only the viewgraphs are given; there is no text. DOE

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-28768 California Univ., Los Angeles.
TARGET TRACKING IN THE PRESENCE OF INTERFERENCE Ph.D. Thesis
Kerim Demirbas 1981 364 p
Avail: Univ. Microfilms Order No. 8113839

Algorithms which can be used to estimate the states of both linear and nonlinear models with or without interference are presented. First, linear models with interference are considered, and then the classical estimation algorithms are applied to estimate the states. Next, three smoothing algorithms are developed for both linear and nonlinear discrete models with or without random interference. For the disturbance noise, observation noise, and interference; only independency is required; Gaussian assumption is not necessary. Moreover, the motion and observation models are not restricted to be linear functions of the disturbance noise and interference. The models' functions are not limited to continuous functions. These smoothing algorithms estimate the states by first quantizing them and then using Decoding Techniques of Information Theory. Simulation results, which are also presented, show that for either linear or nonlinear models with interference, the smoothing algorithms perform very well. Dissert. Abstr.

N81-28769 Purdue Univ., Lafayette, Ind.
ALGORITHMS FOR MATCHING RELATIONAL STRUCTURES AND THEIR APPLICATIONS TO IMAGE PROCESSING Ph.D. Thesis
Jong-Keung Cheng 1980 216 p
Avail: Univ. Microfilms Order No. 8113658

A fast subgraph isomorphism algorithm is proposed using resolution, and the updating rule for a fuzzy model is modified so that it is more suitable for image understandng. The main contributions are the observation of the difference between the topological mapping and embedded mapping, and the idea of the star structure which has several advantages over the conventional node structures. In applications to real pictures the objects are embedded in the picture plane. The spatial relationship among the primitive of the object is fixed. Spatial orderings as well as the measurements of numerical attributes among primitives are essential clues for narrowing the search space in the search tree. The mappings which make use of these clues to eliminate several mappings which are topologically possible but practically impossible are called embedded mappings. The idea of star structure is made possible by use of embedded mapping. It has more refinement power in the search process than the conventional node structure and there is no need to store a large compatibility table which involves four variables. Dissert. Abstr.

N81-28770 Purdue Univ., Lafayette, Ind.
CLASSIFICATION OF VOLTAMMETRIC DATA USING COMPUTERIZED PATTERN RECOGNITION Ph.D. Thesis
Steven Dale Schachterle 1980 192 p
Avail: Univ. Microfilms Order No. 8113750

Computerized pattern recognition was used for discriminating between complicated and uncomplicated electrode processes, and for identifying the mechanism of the electrode process using the shape information contained in the data from a single voltammetric experiment. The voltammograms are represented by their Fourier transforms and are classified using a training set composed of curves based on the theory for cyclic linear sweep voltammetry (CLSV). Features selected to give the best classification accuracy with theoretical CLSV data could then be used for the classification of experimental CLSV or cyclic staircase voltammetry data. The use of theoretical curves in the training set allows broad coverage of both the types of electrode processes and values of fundamental parameters, such as rate constants,

n-values, etc. Several feature sets based on the Fourier transform were tested, involving either scaling of the features or combinations of features which emphasize changes in curve shape with changing scan rate. Of the six feature sets tried, the unscaled Fourier transform coefficients were found to give the best classification results on the experimental data. Dissert. Abstr.

N81-28771 Washington Univ., Seattle.
EXTENSION OF THE TYPE CONCEPT IN PROGRAMMING LANGUAGES Ph.D. Thesis
Roger Kenneth Atlas 1981 191 p
Avail: Univ. Microfilms Order No. 8113430

The ramifications of extending the concept of TYPE in programming languages to include partitioning of variables with classifications derived from the world being modelled by the program are discussed. One proposed partitioning scheme is based on the objects being described by the variables. The second partitioning scheme is based on the property of the object used in the description. These two partitions are compared to partitions based on other schemes such as the partion by hardware representation of a variable. Logical outgrowths of this extension appear in many programming language features and affect both syntax and semantics. In particular, conversion between types takes on a new meaning which leads to adding dimensional analysis and scale conversion to a language. In addition, the approach to assertions, exception handling, procedure calls, and variable naming conventions are changed by this language extension. Illustrative syntaxes are proved to show that these extensions could be embedded in a computer language in current use. Supporting evidence from analysis of computer programs and the study of natural language indicates that these language extensions will increase the reliability of software. Dissert. Abstr.

N81-28772 California Univ., Berkeley.
COMMUNICATION OF COMPOSITE SOURCES Ph.D. Thesis
Shrikant Anand Garde 1980 97 p
Avail: Univ. Microfilms Order No. 8113040

The effectiveness of block coding schemes in encoding a composite source is examined. A source is made up of a number of component subsources; a switch controls which of the subsources is connected to the (composite) source output at any given time instant. A composite source made up of two independent, stationary subsources is analyzed. The Markov switch is unbiased to the two subsources and the encoder has side information about switch positions. Tight upper and lower bounds on the rate distortion function of such a composite source are obtained. In another encoding approach, the composite source is bifurcated into two joined sources. Towards finding good encoding schemes for such joined sources, the closeness of these sources to the original subsources is examined. The composite source model includes a biased switch, an encoder with no side information about switch positions and a finite number of subsources. Dissert. Abstr.

N81-28773 Colorado Univ. at Boulder.
STATIC ANALYSIS OF THE SYNCHRONIZATION STRUCTURE OF CONCURRENT PROGRAMS Ph.D. Thesis
Richard Newton Taylor 1980 148 p
Avail: Univ. Microfilms Order No. 8114013

The feasibility of developing static analysis techniques is investigated. The questions of determining the various ways processes can synchronize determining what program actions can occur in parallel, and detecting errors in the synchronization structure which result in infinite wait are all explored. Programs written in Ada and Ada-like programming languages are the particular subject of the research, such languages being chosen because of their higher level synchronization mechanisms and potential widespread application. Two major results are presented. The first is a demonstration that, for arbitrary programs, the analysis questions posed above must be considered intractable. The second result is the development of an analysis procedure which, in spite of being exponential in nature, is expected to be able to perform the specified analysis in an acceptably efficient manner for many standard applications. Also presented with the analysis procedure is a programming methodology whose application promotes efficient analysis as well as more understandable concurrent programs. Dissert. Abstr.

N81-28774 California Univ., Los Angeles.
A DENOTATIONAL SEMANTICS IMPLEMENTATION SYSTEM Ph.D. Thesis
Roberto DaSilva Bigonha 1981 442 p
Avail: Univ. Microfilms Order No. 8113816

A system for formulating, testing an implementing denotational semantic definitions is designed and formally defined. Mosses' semantics implementation system (SIS) was taken as a starting point SIS has modified and extended in order to increase its expressive power and to enhance reliability and readability of denotational definitions. The main work is toward the definition and specification of a machine processable denotational semantic language (SDL) for conveying modular denotational semantic definitions. In addition to the usual notation of semantic equations, SDL contains specially designed constructs to facilitate modularization and data abstraction. Dissert. Abstr.

N81-28775 California Univ., Los Angeles.
A GRAPH THEORETIC APPROACH TO THE VALIDATION OF SOFTWARE MAINTENANCE MODIFICATIONS Ph.D. Thesis
Kurt F. Fischer 1980 141 p
Avail: Univ. Microfilms Order No. 8113847

Techniques for the validation of software modifications made during the maintenance phase are addressed. The approach taken was to define alternative retest strategies, develop technique for their implementation using graph theory and 0-1 integ programming, examine their performnce characteristics, and discuss practical implementation considerations. The six defined strategies were: (1) rerun all previously executed tests; (2) retest all testable paths through the changed code; (3) rerun all tests which execute the changed code; (4) retest all statements reachable from the changed code; (5) retest all statements reaching to or reachable from the changed code; (6) retest all statements reaching to the changed code and setting changed data, and reached from the changed code and using changed data. The results showed that using strategies 4, 5, and 6 generally reduced the amount of retesting as compared with the nominal strategies of 1 and 3. Even though there is a cost associated with running the retest model, the total cost of retesting was shown to be significantly less for strategies 4, 5, and 6. Dissert. Abstr.

N81-28776 California Univ., Los Angeles.
ERROR-CODED ALGORITHMS FOR ON-LINE ARITHMETIC Ph.D. Thesis
Abdolali Gorji-Sinaki 1981 227 p
Avail: Univ. Microfilms Order No. 8113852

The feasibility of error-coded on-line arithmetic suitable for distributed systems is demonstrated. A set of error-coded on-line algorithms was developed for the four basic operations of addition/subtraction, multiplication, and division. Low cost arithmetic error codes (Residue and AN Codes) were found to be suitable for this purpose. Hardware design of the error-coded units at the gate level was considered. A residue coded on line division unit was designed based on an already designed digit slice division unit. A general mathematical model for the cost and speed of the error-coded units was derived and was compared with similar values when no error code is used. Finally, the effectiveness of the proposed detection/correction schemes was considered and proved. Dissert. Abstr.

N81-28777 California Univ., Los Angeles.
THE USE OF A MODULE INTERFACE DESCRIPTION IN THE SYNTHESIS OF RELIABLE SOFTWARE SYSTEMS Ph.D. Thesis
Maria Heloisa Penedo 1980 314 p
Avail: Univ. Microfilms Order No. 8113875

A module interface description (MID) model, which describes the structure of code is presented. This is MID model, together with a model of the structure of instantiations is used in the synthesis of software systems to detect inconsistencies in the design and to provide a path from modelling to realization of a system. The SARA (System Architect's Apprentice) system provides computer aid to both hardware and software design. By effecting a mapping between SARA models and MID models, it then becomes clear how to create a tool to accept these descriptions and perform various checks on the modelling and

implementation description. Furthermore, it provides for automatic generation of code skeletons. The SARA Design Methodology, including SARA's SL1 (Structural Language 1) and GMB (Graph Model of Behavior) models, is analyzed when used to model concurrent systems. A synchronization scheme to be used during a SARA design procedure is proposed and a mapping between predicate path expressions and GMB is defined. Dissert. Abstr.

N81-28778 Purdue Univ., Lafayette, Ind.
ENHANCED EFFORT ESTIMATION BY EXTENDING BASIC PROGRAMMING MODELS TO INCLUDE MODULARITY FACTORS Ph.D. Thesis
Scott Norman Woodfield 1980 152 p
Avail: Univ. Microfilms Order No. 8113776

Models of modularity factors are developed and used to better comprehend both program construction and comprehension. The two main models developed are the logical module model and the interconnection model. The first reflects the logical segmentation of large physical modules. The second model enables the estimation of complexity associated with module coupling. The models were validated using two sets of experimental data which were collected on two different occasions. Further support was given when the models were able to explain the results of a comprehension experiment, which was conducted to determine how comment and modularization factors affect comprehension. The extended complexity measure was able to account for 80 percent of the variance in the data's complexity. The inclusion of all factors reduced the average relative error from 150 percent to 1 percent. Dissert. Abstr.

N81-28779 California Univ., Berkeley.
AN INPUT DOMAIN BASED THEORY OF SOFTWARE RELIABILITY AND ITS APPLICATION Ph.D. Thesis
Farokh Boman Bastani 1980 175 p
Avail: Univ. Microfilms Order No. 8112956

A theory of software reliability is developed based on the nature of the input domain of the program, i.e., the size of the errors and the number, complexity, and continuity of equivalence classes formed in the input domain. A general framework is developed for software reliability growth models used during the debugging phase of software development. It incorporates the concepts of residual error size and the testing process used. Two specific models are then developed. The first approach models the effect of debugging on the residual error size as a random walk process with a continuous state space. The time between the detection (and correction) of successive error is then modeled as a doubly stochastic Poisson process. The second approach is a Bayesian one dealing with the prior and posterior distributions of the residual error size. A predictive model, applicable during the operational phase, is developed based on the continuity of the input domain. An uncertainty measure using fuzzy set theory is proposed for the operational software. The perturbation of the residual error size due to different maintenance activities is also discussed. The theory is then applied to the evaluation of software validation techniques and programming languages.
Dissert. Abstr.

N81-28780 California Univ., Berkeley.
ALGORITHMS USING LIE TRANSFORMATION GROUPS TO SOLVE FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS ALGEBRAICALLY Ph.D. Thesis
Bruce Walter Char 1980 170 p
Avail: Univ. Microfilms Order No. 8112985

The problem of finding closed-form solutions to first order, first degree differential equations $g(x,y)y(x) + f(x,y) = 0$ is investigated. The application of results discovered by Sophus Lie to algorithmic solution of classes of first order equations, and as the basis of a unified framework in which to search for a solution is explored. Statements and proofs of correctness are given or procedures that decide if an elementary Lie transformation group helps solve a given equation or not. Many of the elementary types of equations can be solved through these methods, in addition to types of equations solved through simple changes of variables. An implementation of the procedures is evaluated and it is found that in the present implementation, the group-finding algorithms do not seem competitive in speed with previously developed techniques for the most basic types of equations; they would best be used when other techniques fail. Dissert. Abstr.

N81-28781# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LINEAR PROGRAMMING AND SUBOPTIMAL SOLUTIONS OF DYNAMICAL SYSTEMS CONTROL PROBLEMS
Decio Castilho Ceballos and Atair Rios Neto May 1981 7 p refs Presented at the Intern. Symp. on Spacecraft Dyn., Darmstadt, West Germany, 17-23 May 1981
(INPE-2076-RPE/311) Avail: NTIS HC A02/MF A01

Linear programming is used to obtain a direct search procedure for parameter optimization in the numerical solution of dynamical systems control problems including those where state inequality constraints are presented. The procedure applies to optimal control problems which uses the Raileigh-Ritz method to obtain a suboptimal approximation, imposing a particular mathematical form to the control function, making it dependent upon a finite number of parameters. It is shown that state inequality constraints can be included without the need of using penalty function methods. E.A.K.

N81-28782# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LMP, A HORIZONTAL MICROPROGRAMMING LANGUAGE AS A CAD TOOL
Wilson Yamaguti May 1981 17 p refs Proposed for presentation at the Interr. Conf. on CAD/CAM, (IFIP/SUCESU), Sao Paulo, Brazil, 21-23 Oct. 1981
(INPE-2057-RPE/303) Avail: NTIS HC A02/MF A01

A microprogramming language denominated LMP is presented. It is a computer-aided design tool tailored for use in the development of microprogrammed systems. The prime design goal of this language is to provide a tool to produce efficient microcode in the case of horizontal microprogramming. Another objective is to offer support with a standard form for microprogram documentation. M.G.

N81-28783*# Kentron International, Inc., Hampton, Va.
ISSYS: AN INTEGRATED SYNERGISTIC SYNTHESIS SYSTEM
A. R. Dovi Feb. 1980 257 p refs
(Contract NAS1-13500)
(NASA-CR-159221) Avail: NTIS HC A12/MF A01 CSCL 09B

Integrated Synergistic Synthesis System (ISSYS), an integrated system of computer codes in which the sequence of program execution and data flow is controlled by the user, is discussed. The commands available to exert such control, the ISSYS major function and rules, and the computer codes currently available in the system are described. Computational sequences frequently used in the aircraft structural analysis and synthesis are defined. External computer codes utilized by the ISSYS system are documented. A bibliography on the programs is included. E.A.K.

N81-28784# Computer Systems Management, Inc., Arlington, Va.
MICROCOMPUTER SOFTWARE ENGINEERING, DOCUMENTATION AND EVALUATION Quarterly Technical Report, 1 Jan. - 31 Mar. 1981
James F. Wittmeyer, III 31 Mar. 1981 53 p refs
(Contract MDA903-80-C-0155; ARPA Order 3829)
(AD-A100103; CSM-81-02) Avail: NTIS HC A04/MF A01 CSCL 09/2

Microcomputer software for defense applications should be engineered structurally, informed by requirements analyses. Documented unconventionally if necessary, and systematically evaluated against an explicit set of performance criteria.
Author (GRA)

N81-28785# TRW Defense and Space Systems Group, Redondo Beach, Calif.
AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR SOFTWARE COST ANALYSIS AND ESTIMATING Final Report
R. W. Wolverton Sep. 1980 173 p refs
(Contract F33657-76-C-0677; AF Proj. 2238)

(AD-A100215; TRW-30323-6012-TU-00; ASD-TR-80-5025)
Avail: NTIS HC A08/MF A01 CSCL 09/2

This guidebook assists Air Force Program Office engineering and management personnel in costing embedded software for avionics applications. A methodology for cost reporting and avoiding the '90 percent complete' syndrome is presented. An annotated bibliography gives the author's personal view of source material relevant to avionics software costing using modern programming practices. Author (GRA)

N81-28786# TRW Defense and Space Systems Group, Redondo Beach, Calif.

AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR CONTRACTING FOR SOFTWARE ACQUISITION Final Report

R. Agnos Aug. 1980 69 p
(Contract F33657-76-C-0677; AF Proj. 2238)
(AD-A100217; TRW-30323-6007-TU-00; ASD-TR-80-5024)
Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is one of a series of guidebooks whose purpose is to assist Air Force Program Office and Engineering personnel in the acquisition of weapon systems containing software. This guidebook provides information about the technicalities of DOD contracting to enable Program Office and Software Engineering personnel to effectively work the Procuring Contracting Officer (PCO) and other members of the acquisition team. Author (GRA)

N81-28787# TRW Defense and Space Systems Group, Redondo Beach, Calif.

AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR APPLICATION AND USE OF THE GUIDEBOOKS (SERIES OVERVIEW) Final Report

L. Parriott Oct. 1980 55 p
(Contract F33657-76-C-0677; AF Proj. 2238)
(AD-A100216; TRW-30323-6003-TU-00; ASD-TR-80-5028)
Avail: NTIS HC A04/MF A01 CSCL 09/2

This guidebook serves as an introduction to the Airborne Systems Software Acquisition Engineering guidebook series which describes significant activities and events in the software acquisition life cycle of airborne embedded computer systems acquired within the framework of Air Force 800-series documents. This guidebook contains a brief description of the other fifteen guidebooks and discusses the application and use of the various guidebooks during the acquisition of embedded weapon system software. Author (GRA)

N81-28788# TRW Defense and Space Systems Group, Redondo Beach, Calif.

AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR SUPPORTABLE AIRBORNE SOFTWARE Final Report

K. Meyer Oct. 1980 83 p refs
(Contract F33657-76-C-0677; AF Proj. 2238)
(AD-A100213; TRW-30323-6015-TU-00; ASD-TR-80-5026)
Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is one of a series of guidebooks whose purpose is to assist Air Force Program Office and engineering personnel in the acquisition and engineering of airborne systems software. This guidebook addresses topics relevant to software supportability. It provides guidance for preparation of the Computer Resources Integrated Support Plan (CRISP) and discusses the acquisition of supportable airborne software through review of the development effort. Author (GRA)

N81-28789# TRW Defense and Space Systems Group, Redondo Beach, Calif.

AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR SOFTWARE DEVELOPMENT AND SUPPORT FACILITIES Final Report

F. Kishi Sep. 1980 122 p
(Contract F33657-76-C-0677; AF Proj. 2238)
(AD-A100214; TRW-30323-6019-TU-00; ASD-TR-80-5027)
Avail: NTIS HC A06/MF A01 CSCL 09/2

This report is one of a series of guidebooks whose purpose is to assist Air Force Program Office and Engineering personnel in the acquisition and engineering of airborne systems software. This guidebook addresses ground-based facilities used for software development, modification, integration, and testing on Avionics Embedded Computer Systems (ECS) during both the Full Scale Engineering Development phases and the Operations and Support phase of the ECS life cycle. It provides assistance to the Air Force Program Office in the acquisition of software development and support facilities in the specific areas of (1) establishing requirements for facility acquisition; (2) performing facility planning; and (3) establishing procedures used development/acquisition and operations. Author (GRA)

N81-28790# Naval Postgraduate School, Monterey, Calif.

A CONCEPTUAL FRAMEWORK FOR GRAMMAR-DRIVEN SYNTHESIS M.S. Thesis

William R. Shockley and Daniel P. Haddow Dec. 1980 179 p refs
(AD-A100159) Avail: NTIS HC A09/MF A01 CSCL 09/2

Conventional parsing techniques use grammars as embedded procedural knowledge bases in mechanisms which are capable of translating words in the language defined into equivalent parse trees. The approach described in this paper uses context-free grammars as data allowing access to synthesis templates which enable the user to create and interact with parse trees directly. The advantages of this approach are the utility of human-oriented grammars, the dynamic interchangeability of language definitions, immediate error rejection, and the ability to handle partially complete parse trees. The design for a prototype programming environment using grammar-driven synthesis is presented. Author (GRA)

N81-28791# California Univ., Livermore. Lawrence Livermore Lab.

RECFIL: SOFTWARE PACKAGE FOR RECURSIVE DIGITAL FILTERING

David Harris 10 Apr. 1981 44 p ref
(Contract W-7405-eng-48)
(UCID-19021) Avail: NTIS HC A03/MF A01

The purpose of this software package is to provide basic recursive digital filtering capabilities. The subroutines provided design and implement four kinds of filters: lowpass, highpass, bandpass and bandreject filters. The package is designed to be used by making a single call to the main subroutine RECFIL from the user's code. The interface is very simple and under the control of the user. GRA

N81-28792# Los Alamos Scientific Lab., N. Mex.

COMPUTING PERCENTILES OF LARGE DATA SETS

J. A. Howell 1981 4 p refs Presented at the 13th Symp. on the Computer Sci. and Statist. Interface, Pittsburgh, 12 - 13 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-1024; CONF-810342-1) Avail: NTIS HC A02/MF A01

An algorithm for finding percentiles of large data sets (those having 100,000 or more points) is described. This algorithm does not involve sorting the entire data set. The data are sampled and a guess for the percentile is obtained. Then the guess is used to extract a subset of the original data through which a search for the true percentile is conducted. DOE

N81-28793# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.

DATA DISPLAY ON A VIDEO MONITOR (INTEL 8080 SYSTEM). DEVELOPMENT OF A PROGRAMMING DEVICE WHICH SUBSTITUTES FOR EPROM'S TYPE 2708 [DATENAUSGABE UEBER EINEN VIDEOMONITOR (SYSTEM INTEL 8080). PROGRAMMIERGERAET ZUM ERSATZ VON EPROM'S 2708]

R. Schmidt, E. Ofner, and N. Valavanoglou May 1979 55 p refs In GERMAN; ENGLISH summary
(INW-7906) Avail: NTIS HC A04/MF A01

A data processing unit for real time PCM data handling was developed. Software and hardware nodules which allow for display of computed values on a TV monitor are presented. Preprogrammed displays are for application in data processing related to balloon experiments. As an aid in the development project, a programming device which can substitute for all functions of a programmed EPROM type 2708 was also built. The use of this equipment is described. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N81-28794 Purdue Univ., Lafayette, Ind.
PERFORMANCE OPTIMIZATION OF PARALLEL PROCESSING COMPUTER SYSTEMS Ph.D. Thesis
Lionel Ming-Shuan Ni 1980 188 p
Avail: Univ. Microfilms Order No. 8113735

Array processors that execute a single instruction stream over multiple data streams are extended to the field of multiple vector processng and distributed computation. Performance optimization of two classes of parallel processing computer systems is investigated. One class is the shared-resource Multiple SIMD (MSLMD) array processors, and the other is the distributed Multiple Processor System (MPS). In an MSIMD array processor, the optimal size of the resource pool of processing elements and the sufficient buffer size are systematically determined. A probabilistic optimal scheduling policy is developed to achieve load balancing and minimal average job turnaround time in an MPS. Queueing networks are used in modeling the above two types of parallel processing computer systems. Analytical relationships are established between system parameters and a chosen performance criterion. These analytical results are used to optimize the system performance of parallel processing computers. Dissert. Abstr.

N81-28795 Minnesota Univ., Minneapolis.
A DECOMPOSITION APPROACH TO THE MODELLING AND ANALYSIS OF DISTRIBUTED USER RESOURCE COMPUTER NETWORKS Ph.D. Thesis
Nemattolah SamariKermani 1981 193 p
Avail: Univ. Microfilms Order No. 8115036

The development of an analytic model for performance studies of user resource computer networks is discussed. A queueing model was developed to study the behavior of communication subnetwork, and improved and extended to include the entire user resource network. The decomposition approach used to factor each mode of the communication subnetwork into processing and channel components and model each separately using M/D/r and M/M/1 queueing systems, respectively. Then the results of these queueing systems were used to find the overall average end to end delay for the subnetwork. The model also includes a correction factor to account for the nonexponential nature of the input from processors into channel component.
Dissert. Abstr.

N81-28796*# Maryland Univ., College Park. Dept. of Computer Science.
COMPARATIVE PERFORMANCE EVALUATION OF SEVERAL LOCAL DISTRIBUTED COMPUTER NETWORKS Interim Technical Report
Jonatha R. Agre and Ashok K. Agrawala Dec. 1980 49 p refs
(Contract NAS5-24092; Grant AF-AFOSR-3654-78)
(NASA-CR-164590; AD-A100202; TR-919; AFOSR-81-0484TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

A comparative study of communication technologies for use in local area networks is presented. The technologies considered are: a ring, two cable bus schemes, a circuit switched system, and a shared memory system. These technologies are evaluated under similar operating conditions, loadings, and system configurations via a simulation analysis. Included in the analysis are delays caused by higher level protocol interactions at the host-computer level. The performance of these systems is summarized in the paper. Author (GRA)

N81-28797# National Bureau of Standards, Washington, D.C.
LOCAL AREA NETWORK FEASIBILITY STUDY FOR THE NAVAL SEA SYSTEMS COMMAND
Alan Mink and Charles B. Silio, Jr. Jan. 1981 56 p refs
(PB81-170656; NBSIR-80-2187) Avail: NTIS HC A04/MF A01 CSCL 09B

The Naval Sea Systems Command (NAVSEA) environment is established. This includes the physical and the computing environment. After establishing the environment, a representative set of application programs is used to determine NAVSEA's LAN requirements. A discussion of LAN topologies is presented, and those applicable to NAVSEA are indicated. implementations of these applicable topologies are discussed along with the technologies involved and their advantages and disadvantages.
GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-28798 Purdue Univ., Lafayette, Ind.
SINGULAR OPTIMAL CONTROL Ph.D. Thesis
Yuh-Tai Ju 1980 72 p
Avail: Univ. Microfilms Order No. 8113709

The Singular Optimal Control Problem is solved using the Moore-Penrose inverse for higher order singularities. The linear regulator problem is first formulated to serve as a basic study and the state feedback control is obtained. Nonlinear problems are then introduced and results from the linear regulator problem are modified to get solutions to these problems. Many standard theorems from regular optimal control theory are applied to the singular optimal control problem. An extension of the Matrix Riccati Equation to the Matrix Riccati Inequality for singular problem is discussed. A duality theory between the linear quadratic singular optimal control problem and the linear state estimation problem is also developed and investigated. It is shown how the free-terminal time control problem can be solved by using a transformation on the state and time, and the results are just an extension of the results for the fixed-terminal-time problem. Dissert. Abstr.

N81-28799# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
BEYOND QUESTION-ANSWERING
Philip R. Cohen, C. Raymond Perrault (Toronto Univ., Ontario), and James F. Allen (Rochester Univ.) 15 May 1981 75 p refs
(Contract N00014-77-C-0378; Grant NSF IST-80-12418)
(AD-A100432; BBN-4644) Avail: NTIS HC A04/MF A01 CSCL 09/2

We demonstrate, using protocols of actual interactions with a question-answering system, that users of these systems expect to engage in a conversation whose coherence is manifested in the interpendence of their (often unstated) plans and goals with those of the system. Since these problems are even more obvious in other forms of natural-language understanding systems, such as task-oriented dialogue systems, techniques for engaging in question-answering conversation should be special cases of general conversational abilities. We characterize dimensions along which language understanding systems might differ and, based partly on this analysis, propose a new system architecture, centered around recognizing the user's plans and planning helpful responses, which can be applied to a number of possible application areas. To illustrate progress to date, we discuss two implemented systems, one operating in a simple question-answering framework, and the other in a decision support framework for which both graphic and linguistic means of communication are available.
Author (GRA)

N81-28800# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
FEEDBACK SYSTEM THEORY Final Report, 1 Nov. 1975 - 31 Oct. 1980
Isaac M. Horowitz Oct. 1980 8 p refs
(Contract AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A100204; AFOSR-81-0490TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

The basic reason for using feedback in control is to cope with uncertainty in plant parameters and plant disturbances, and to obtain plant performance otherwise unattainable. However, most of the feedback control literature has tended to be qualitative rather than quantitative, with uncertainties undefined or even completely ignored. This research has been highly quantitative with great emphasis on precise definition of the plant uncertainty

and of the performance tolerances, to be achieved despite the uncertainty. Also, the practical aspects have been considered by attention to the gain and bandwidth of the compensation needed in the feedback loops. This is the true measure of the cost of feedback, which has been ignored in 'modern' state-variable control theory, leading them to totally impractical unachievable infinite bandwidth amplifiers. In our research in quantitative synthesis, the uncertainties are precisely defined, the compensation must be realizable, and practical, transparent synthesis techniques are sought. A transparent technique is one in which the designer clearly sees, as he proceeds, the trade-offs between the important design factors, and can choose between them; for example, bandwidth and therefore sensor noise effect conservation versus compensation complexity. During the five-year period, quantitative, transparent synthesis techniques have been developed for the first time, for certain classes of feedback control systems.
Author (GRA)

N81-28801# Maryland Univ., College Park. Dept. of Computer Science.
AN APPROXIMATE TRANSIENT ANALYSIS OF THE Mt/M/1 QUEUE Interim Report
Richard A. Upton and Satish K. Tripathi Oct. 1980 54 p refs (Grant AF-AFOSR-3654-78; AF Proj. 2304)
(AD-A100179; TR-955; AFOSR-81-0485TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

An approach, based on recent work by Stern (STER 1979), is described for obtaining the approximate transient behavior of both the M/M/1 and the M(t)/M/1 queues, where the notation M(t) indicates an exponential arrival process with time-varying parameter lamda (t). The basic technique employs an M/M/1/K approximation to the M/M/1 queue to obtain a spectral representation of the time-dependent behavior for which the eigenvalues and eigenvectors are real. Following a general survey of transient analysis which has already been accomplished, Stern's M/M/1/K approximation technique is examined to determine how best to select a value for K which will yield both accurate and computationally efficient results. It is then shown how the approximation technique can be extended to analyze the M(t)/M/1 queue where we assume that the M(t) arrival process can be approximated by a discretely time-varying Poisson process. An approximate expression for the departure process of the M/M/1 queue is also proposed which implies that for an M(t)/M/1 queue whose arrival process is discretely time-varying, so too the departure process can be approximated as discretely time-varying (albeit with a different time-varying parameter).
GRA

N81-28802# Oxford Univ. (England). Dept. of Engineering Science.
STOCHASTIC OPTIMAL CONTROL AND ITS CONNECTION WITH ESTIMATION
R. Gessing (Technical Univ. of Gliwice, Poland) 1980 24 p refs
(OUEL-1328/80) Avail: NTIS HC A02/MF A01

A formulation of the stochastic control problem is described in which the primary and secondary performance indexes are distinguished. A minimization and averaging principle, defining the connection between the two indices, is established, and conclusions resulting from the principle are discussed. The connection between the minimal value of the secondary perfomance index and the primary performance index is expressed in the min-E principle. This uses properties of the sequence of min and E operations to demontrate the influence of available information on the quality of the control. This influence is illuminated by A lemma which shows the effect of changing the order of the min and E operations. Notation for the generalized certainty equivalence principle is also presented. The original generalized recursive estimation problem, which is equivalent to the stochastic optimal control problem, is formulated and solved. Author (ESA)

N81-28803# Sheffield Univ. (England). Dept. of Control Engineering.
ROBUST CONTROL OF UNKNOWN OR LARGE-SCALE SYSTEMS USING TRANSIENT DATA ONLY
D. H. Owens and A. Chotai Nov. 1980 48 p refs (Grant SRC-GR/B/23250)
(RR-134) Avail: NTIS HC A03/MF A01

Controller design for a possibly unknown discrete or continuous multivariable system using only simple graphical and computational steps based on open loop step response data is considered. Conditions are derived describing a high performance controller for a plant for which rise time and steady state data alone are available. A conceptual approximate process model is used to identify the structural properties, the form of the parametric controller, and the available tuning parameters. The controller struture is shown to be easily obtained leaving the required performance to be obtained by tuning of loop parameters. A guide to the required parameters is obtained by analysis of the first order approximate model. The main theorems guarantee conditions under which suitable tuning parameters exist. The results are illustrated by numerical examples. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-28804 Pennsylvania State Univ., University Park.
ESSAYS ON THE THEORY AND APPLICATIONS OF GENERALIZED FUNCTIONS Ph.D. Thesis
Ricardo Estrada-Navas 1981 129 p
Avail: Univ. Microfilms Order No. 8112800

Four essays on the theory and applications of generalized functions are presented. The concepts of the surface distributions are explained. The first and higher order distributional derivatives are derived for a function of several variables. These concepts are used to study the propagation of wave front in continuum mechanics. Explicit formulas for the jump relations for the first and second order partial derivatives are obtained across the wave front. A theory for distributional boundary values of harmonic and analytic functions is presented. Several indictors that measure the growth of these functions near the boundaries are introduced. An extension of the Phragmen-Lindelof maximum principle is derived. The investment behavior of a firm facing costs of adjustment is studied. The weak lower semicontinuous extension of the cost functional is derived. It is proved that the appropriate functional which correctly portrays the cost of adjustment derives froma convex function. The general solution of the dual integral equations of the Titchmarsh type when the data in these equations are arbitrary generalized functions is derived. An explicit solution is found and non-uniqueness is established.
Dissert. Abstr.

N81-28805 California Univ., Berkeley.
EXTENSION OF GLIMM'S METHOD TO THE PROBLEM OF GAS FLOW IN A DUCT OF VARIABLE CROSS-SECTION Ph.D. Thesis
Simon KaMan Fok 1980 118 p
Avail: Univ. Microfilms Order No. 8113033

Various numerical methods for extending Glimm's scheme to solve a nonlinear hyperbolic system of partial differential equations in one space variable are described. The reason for considering Glimm's scheme is because of its ability to pick out the correct weak solution of a given hyperbolic system of partial differential equations without requiring it to be written in conservation form. The numerical schemes considered are: (1) generalized Glimm's scheme, (2) Glimm's scheme with Sod's operator splitting method, and (3) Liu's scheme. In particular, the inhomogeneous Burgers' equation and the problem of radial symmetric gas flow is studied, and Sod's operator splitting method is seen to be best among the three numerical schemes. Finally, gas flow in a duct of variable cross section is discussed together with the classical Chisnell's formula which describes the changes in the speed of the shock with respect to the varying cross sectional area. The case of a variable area duct can be handled by hybridizing Glimm's scheme (with operator splitting and Chisnell's formula) and Liu's scheme (with Chisnell's formula).
Dissert. Abstr.

N81-28806 Colorado Univ. at Boulder.
SPECTRAL AND NUMERICAL RANGE THEORY FOR BANACH ALGEBRAS, FORMS, AND UNBOUNDED

OPERATORS Ph.D. Thesis
Morteza Seddighin 1980 115 p
Avail: Univ. Microfilms Order No. 8114004

Those Banach algebras in which Weyl's theorem has a converse are studied and some results on commutators of operators on Hilbert spaces to these algebras are extended. Examples of noncommutative Banach algebras other than B(H) on which West decomposition theorem for Riesz elements remains true, are given and it is shown that a theorem of Brown, Pearcy, and Salinas yields a result closely related to the West theorem. Applying the theory of perturbation to accretive operators on Hilbert spaces, sufficient conditions are found for an accretive operator to have a certain type of additive representation. Using such representations, sufficient conditions are given for an unbounded square of an operator to be accretive. It is shown that the numerical range of certain unbounded operators on a certain class of Banach spaces is unbounded. Dissert. Abstr.

N81-28807 Tennessee Univ., Knoxville.
APPLICATIONS OF DIFFERENTIAL INEQUALITIES TO PERSISTENCE AND EXTINCTION PROBLEMS FOR REACTION-DIFFUSION SYSTEMS Ph.D. Thesis
Linda Joy Allen 1981 184 p
Avail: Univ. Microfilms Order No. 8115240

Systems of nonlinear reaction-diffusion equations representing models of competition, predation, and mutualism are presented and discussed. The models are divided into two categories, patch models and continuous models which can be represented by systems of ordinary differential equations or by systems of partial differential equations, respectively. Within each of these categories there are four types of diffusion mechanisms, random, biased, directed, and predator-prey diffusion. Conditions for system persistence and extinction are sought. The main tool employed to determine the persistence and extinction criteria is differential equalities. The Comparison Principle of ordinary differential equation theory and the Maximum Principle of partial differential equation theory are used to prove many of the persistence and extinction results. Dissert. Abstr.

N81-28808 Rochester Univ., N. Y.
BOUNDARY REGULARITY OF SOLUTIONS TO A FREE BOUNDARY VARIATIONAL PROBLEM Ph.D. Thesis
Edith Ann Cook 1981 135 p
Avail: Univ. Microfilms Order No. 8114131

The regularity at the boundary of surfaces which solve a certain free boundary variational problem were discussed. A solution is established by a standard compactness argument of geometric measure theory. The proof of regularity combines geometric measure theory and the theory of regularity of solutions to partial differential equations. Since the surface and free boundary satisfy certain minimizing properties, this function satisfies a partial differential equation and boundary condition. This boundary condition satisfies a nondegeneracy condition. Dissert. Abstr.

N81-28809 Iowa Univ., Iowa City.
ON THE NUMERICAL SOLUTION OF FREDHOLM INTEGRAL EQUATIONS OF THE SECOND KIND Ph.D. Thesis
Pedro Oscar Cubillos-Herrera 1980 121 p
Avail: Univ. Microfilms Order No. 8114248

Two problems in the numerical solution of integral equations were studied. The first problem is the numerical calculation of the eigenvalues and eigenfunctions of a compact integral operator. Iterative methods are given and a complete error analysis is carried out. The method are based on the Nystrom method and the Newton-Kantorovich theorem for nonlinear operators. The second problem is the numerical treatment of integral equations with a kernel which is not sufficiently smooth. Two numerical methods are proposed and analyzed. The material is applied to an eigenvalue problem for ordinary differential equations, to a boundary value problem for first order linear systems and to a class of nonlinear integral equations. Dissert. Abstr.

N81-28810*# Washington Univ., St. Louis, Mo. Center for Computational Mechanics.
ADAPTIVE FINITE ELEMENT TECHNOLOGY IN INTEGRATED DESIGN AND ANALYSIS Final Report, 1 Oct. 1979 - 31 Dec. 1980
B. A. Szabo, P. K. Basu, D. A. Dunavant, and D. Vasilopoulos Jan. 1981 94 p refs
(Grant NsG-1640)
(NASA-CR-164560; WU/CCM-81/1) Avail: NTIS HC A05/MF A01 CSCL 12A

An assessment of the potential impact of adaptive finite element technology on the analysis part of the aircraft structural synthesis process is presented. The main conclusion is that adaptive application of the p-version of the finite element method based on indirect error estimation procedures results in substantial cost reduction and increased reliability of the computed data. Adaptivity based on direct a posteriori error estimation has the potential for additional savings. M.G.

N81-28811# Queensland Univ., St. Lucia (Australia). Dept. of Civil Engineering.
A SECOND GENERATION FRONTAL SOLUTION PROGRAM
G. Beer May 1980 45 p refs
(RR-CE-12) Avail: NTIS HC A03/MF A01

A computer program for the assembly and solution of symmetric positive definite equations as seen in the finite element analysis based on the frontal solution algorithm is presented. The program features improved direct access blocked I/O and the use of front partitioning which makes the problem a size which can be solved practically independent of the size of the computer memory. In addition, the use of fast vector processors is considered which should improve CPU times considerably. M.G.

N81-28812# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
APPROXIMATIONS FOR G(s)F(s) ADJUSTED FOR UNIT STEP RESPONSE VIA RESIDUES
Richard E. Dickson Apr. 1981 8 p refs
(AD-A100297; AD-E950129) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using an approximate for z G(s)F(s) based upon the second order Runge-Kutta integrator family, a recurrence for a single real pole filter was developed. The recurrence is exact for any size time step when the input is a damped exponential with identical time constant. The unit step into a single integrator is just a special case. A residue is then introduced into the real pole filter so that the recurrence is exact for a unit step input and any size time step. Author (GRA)

N81-28813# Texas Univ. at Arlington. Center for Cybernetics Studies.
MATHEMATICAL OPTIMIZATION: A SUCCESSFUL TOOL FOR LOGISTICS PROBLEMS
Fred Glover and Darwin Klingman Jan. 1981 24 p refs Presented at the IFORS Conf., Hamburg, West Germany, 20-24 Jul. 1981 Prepared in cooperation with Colorado Univ., Boulder
(Contracts N00014-78-C-0222; N00014-75-C-0569)
(AD-A100456; CCS-392) Avail: NTIS HC A02/MF A01 CSCL 15/5

Recent developments in mathematical optimization are substantially enhancing the scope and power of logistics planning systems. Based on these advances, successful applications of sophisticated mathematical optimization logistics systems are occurring worldwide. This paper briefly discusses some of these applications and advances. Author (GRA)

N81-28814# Texas Univ. at Arlington. Center for Cybernetic Studies.
NETGEN-2: A SYSTEM FOR GENERATING STRUCTURED NETWORK-BASED MATHEMATICAL PROGRAMMING TEST PROBLEMS
Joyce J. Elam and Darwin Klingmna Jan. 1981 14 p refs
(Contract N00014-80-C-0242; Grant NSF MCS-78-27590)
(AD-A100457; CCS-393) Avail: NTIS HC A02/MF A01 CSCL 12/2

The increased importance of designing and implementing algorithms to solve particular management problems has created the need for more robust test problem generators that can match the overall structure and parameter values of these problems. Of particular interest are management problems that can be

modeled using a network structure. This paper discussed the design of a system for generating network-based mathematical programming test problems that conform to user-supplied structural parameter characteristics. Author (GRA)

N81-28815# Texas Univ. at Arlington. Center for Cybernetic Studies.

AN ALGORITHM TO SELECT THE BEST SUBSET FOR A LEAST ABSOLUTE VALUE REGRESSION PROBLEM

R. D. Armstrong and M. T. Kung (McMaster Univ.) May 1981 27 p refs

(Contracts N00014-81-C-0236; N00014-75-C-0569)

(AD-A100460; CCS-396) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers the problem of obtaining the best subset of regressors under a least absolute value criterion. The model is the classic linear regression model with m explanatory variables and a dependent variable. The importance of the explanatory variables is measured by obtaining the minimum sum of absolute deviations when only k of the m explanatory variables are included in the model. An algorithm is presented to obtain the 'best' subset of size k, k = 1,...,m. Several algorithms to solve the best subset problem are available when the criterion for evaluation is least squares. However, recently statisticians have become increasingly aware of the limitations of least squares and have popularized 'robust-resistant' estimation techniques. Least absolute values is such a technique. Special purpose computer codes which utilize the simplex algorithm of linear programming are used to solve the least absolute value regression problem. This paper incorporates two of these specialized codes within a branch-and-bound algorithm to solve the best subset problem. GRA

N81-28816# Brown Univ., Providence, R. I. Center for Dynamical Systems.

ASYMPTOTIC BEHAVIOUR OF GRADIENT-LIKE SYSTEMS Interim Report

Jack K. Hale and Paul Massatt (Oklahoma Univ., Norman) 2 Feb. 1981 24 p refs

(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)

(AD-A100203; AFOSR-81-0488TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For class of gradient evolutionary equations, we prove that the w-limit set of a bounded orbit is an equilibrium point if the dimension of the null space of the linear variational operator is no more than one. This implies the result of Matano concerning a parabolic equation in one space dimension with separated boundary conditions. The statement about gradient systems is a consequence of a more general property which has applications, for example, to the stability of traveling waves. GRA

N81-28817# Wisconsin Univ. - Madison. Mathematics Research Center.

RECURRENCE RELATIONS FOR MULTIVARIATE B-SPLINES Technical Summary Report

Carl deBoor and Klaus Hoellig May 1981 9 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)

(AD-A100558; MRC-TSR-2215) Avail: NTIS HC A02/MF A01 CSCL 12/1

We prove recurrence relations for a general class of multivariate B-splines obtained as 'projections' of convex polyhedra. Our results are simple consequences of Stokes' theorem and include, as special cases, the recurrence relations for the standard multivariate simplicial B-spline. Author (GRA)

N81-28818# Wisconsin Univ. - Madison. Mathematics Research Center.

NUMERICAL SOLUTION OF A GASIFICATION PROBLEM Technical Summary Report

Joel C. W. Rogers May 1981 30 p refs

(Contract DAAG29-80-C-0041)

(AD-A100559; MRC-TSR-2216) Avail: NTIS HC A03/MF A01 CSCL 12/1

A problem of gasification and heating of a solid due to the action of an external energy source is discussed. The problem involves a moving boundary when the solid gasifies. At parts of the boundary where gasification is taking place, a model problem looks very much like the one-phase Stefan problem with an energy source at the moving boundary. However, any gas produced is assumed to blow away immediately, and there is no conduction to the solid from the outside, even when the surface temperature of the solid is below the gasification temperature. Accordingly, if the temperature is extended to a function defined over all space by setting it equal to the gasification temperature outside, the temperature will not necessarily be continuous at the boundary, and instead a Neumann condition may be satisfied there. Also, no resolidification is possible, so that the region occupied by the solid cannot increase. Thus, one has the possibility of a situation in which the boundary may alternately move and be stationary. A generalized formulation of the problem is given, a numerical algorithm is described, and computational results are presented. Author (GRA)

N81-28819# Wisconsin Univ. - Madison. Mathematics Research Center.

A SEQUENCE OF PIECEWISE ORTHOGONAL POLYNOMIALS (1) (LINEAR CASE) Technical Summary Report

Y. Y. Feng and D. X. Qi May 1981 17 p refs

(Contract DAAG29-80-C-0041)

(AD-A100560; MRC-TSR-2217) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper considers a sequence of piecewise linear orthogonal functions (U sub i) which is complete in L sub 2. Explicit expressions for the U sub i are given. Any continuous function can be expanded in a series of constant multiples of functions U sub i under the sense of uniform convergence by group. While the partial sum of the corresponding expression for a continuous function may fail to converge uniformly, a certain subsequence does. Author (GRA)

N81-28820# Wisconsin Univ. - Madison. Mathematics Research Center.

A FREE BOUNDARY PROBLEM ARISING FROM A BISTABLE REACTION-DIFFUSION EQUATION Technical Summary Report

David Terman May 1981 42 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-80-17158)

(AD-A100566; MRC-ISR-2223) Avail: NTIS HC A03/MF A01 CSCL 12/1

The mathematical equation studied here has been considered as a model for population genetics, combustion, and nerve conduction. A common feature to all of these phenomena is the existence of traveling wave solutions. These may correspond, for example, to the spread of an advantageous gene through a population or the propagation of electrical impulses in a nerve axon. Another common feature is the existence of a threshold phenomenon. In the nerve, for example, a small initial stimulus will not trigger an impulse. If the initial stimulus is greater than some threshold amount, however, a signal will propagate down the axon. In this case, the signal quickly assumes a fixed shape and travels with constant velocity. Physiologically, it has been demonstrated that this shape and velocity is independent of the initial stimulus as long as the stimulus is above threshold. In this report, we demonstrate that the mathematical model under consideration does indeed exhibit a threshold phenomenon. We also study how initial stimuli evolve into traveling wave solutions. GRA

N81-28821# Wisconsin Univ. - Madison. Mathematics Research Center.

PROPAGATION PHENOMENA IN A BISTABLE REACTION DIFFUSION SYSTEM

John Rinzel and David Terman May 1981 63 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-80-17158)

(AD-A100568; MRC-TSR-2225) Avail: NTIS HC A04/MF A01 CSCL 12/1

Consideration is given to a system of reaction diffusion equations which have qualitative significance for several applications including nerve conduction and distributed chemical/biochemical systems. These equations are of the FitzHugh-Nagumo type and contain three parameters. For certain ranges of the parameters the system exhibits two stable singular points. A singular perturbation construction is given to illustrate that there may exist both pulse type and transition type traveling waves. A complete, rigorous, description of which of these waves exist

for a given set of parameters and how the velocities of the waves vary with the parameters is given for the case when the system has a piecewise linear nonlinearity. Numerical results of solutions to these equations are also presented. These calculations illustrate how waves are generated from initial data, how they interact during collisions, and how they are influenced by local disturbances and boundary conditions. GRA

N81-28822# Pittsburg Univ., Pa. Learning Research and Development Center.

EXPERTISE IN PROBLEM SOLVING

Michelene T. H. Chi, Robert Glaser, and Ernest Rees 18 May 1981 139 p refs

(Contract N00014-78-C-0375)

(AD-A100138; TR-5) Avail: NTIS HC A07/MF A01 CSCL 05/10

It has become increasingly clear in recent years that the quality of domain-specific knowledge is the main determinant of expertise in that domain. This paper begins with an examination of the shift from consideration of general, domain-independent skills and procedures, in both cognitive psychology and artificial intelligence, to the study of the knowledge base. Next, the empirical findings and theoretical models of other researchers in physics problem solving are detailed and summarized. Then our own work is presented, consisting of eight empirical studies. These studies show, in general, the importance of differences in the knowledge bases of experts and novices to their problem solving success. More specifically, they show that it is difficult to use protocols of problem solving episodes to illuminate the differences in the knowledge bases of experts and novices, that experts and novices perceive the problem themselves differently, i.e., novices respond to the surface features of a problem while experts respond to its deep structure, that less successful novices, at least, have deficiencies in their declarative knowledge of physics, that novices tend to lack knowledge of when to use certain physics knowledge, and that deficiencies in knowledge appear to prevent novices at times from making key inferences necessary for solving problems. Finally, these results and their implications for theories of intelligence, are discussed. Author (GRA)

N81-28823# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.

RECENT DEVELOPMENTS IN NUMERICAL ODES

H. A. Watts Mar. 1981 17 p refs Presented at the Simulation Methods for Nucl. Power Systems Conf., Tucson, Ariz., 26-28 Jan. 1981

(Contract DE-AC04-76DP-00789)

(SAND-81-0013; CONF-810113-6) Avail: NTIS HC A02/MF A01

Developments in solving numerically the initial-value problem in ordinary differential equations are overviewed. Their principal topics are discussed--problem classification and stiffness, methods and software, and matters of current and future interest. DOE

N81-28824# Texas Univ., Austin. Inst. for Fusion Studies.

VARIATIONAL STRUCTURE OF THE VLASOV EQUATION

H. L. Berk, R. R. Dominguez (General Atomic Co., San Diego, Calif.), and E. R. Maschke (Euratom, Fonenay-Aux-Roses, France) Mar. 1981 34 p refs

(Contract DE-FG05-80ET-53088)

(DOE/ET-53088/13) Avail: NTIS HC A03/MF A01

The variational structure of the Vlasov-Maxwell integral equations is derived for a plasma equilibrium having two ignorable coordinates. It is shown that the kernel of the Maxwell equations is a self-adjoint integral operator. This operator may also be represented as a differential equation of arbitrary order. This representation is useful when the differential operator is truncated to finite order, yielding a system on intrinsically self-adjoint differential equations. DOE

N81-28825# Denver Univ., Colo. Dept. of Mathematics.

SOME NUMERICAL APPROACHES TO SOLVING ONE-DIMENSIONAL INVERSE PROBLEMS

Frank Hagin 1980 28 p refs

(Contract DE-AC02-80ER-10769)

(DOE/ER-10769/2) Avail: NTIS HC A03/MF A01

A class of one dimensional inverse scattering problems is studied with the goal of reconstructing propagation speed to moderate accuracy as inexpensively as possible. Three alternatives are discussed, all starting from a change to the travel time variable and converting the problem to integral equation form. The approaches are compared as to their economy of use and the problems for which they are effective. Several numerical examples illustrate these comparisons. DOE

N81-28826# Denver Univ., Colo. Dept. of Mathematics.

TOWARD PRECISE SOLUTION OF ONE-DIMENSIONAL VELOCITY INVERSE PROBLEMS

Samuel Gray (General Motors Inst., Flint, Mich.) and Frank Hagin 1980 22 p refs

(Contract DE-AC02-80ER-10769)

(DOE/ER-10769/1; MS-R-8102) Avail: NTIS HC A02/MF A01

A family of one-dimensional inverse problems are considered with the goal of reconstructing velocity profiles to reasonably high accuracy. The travel-time variable change is used together with an iteration scheme to produce an effective algorithm for computation. Under modest assumptions the scheme is shown to be convergent. DOE

N81-28827# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

ANALYSIS OF SOME MIXED FINITE ELEMENT METHODS RELATED TO REDUCED INTEGRATION

Claes Johnson and Juhani Pitkaeranta 1980 59 p refs

(CTH-80.02-R) Avail: NTIS HC A04/MF A01

Error estimates are proved for two mixed finite element methods related to reduced integration. The technique of selective reduced integration is used in order to obtain a balanced discrete model, avoiding the stiffness which characterizes the direct application of the finite element method to specific problems and the consequent poor results. A Stokes' problem using rectangular elements with piecewise bilinear approximations for the velocities and piecewise constants for the pressure, and a plate problem using bilinear approximations for transversal displacement and rotations and piecewise constants for the shear stress are considered. The analysis follows the general lines of Babuska and Brezzi. As the auxiliary variable (the pressure in Stokes' problem) is only controlled in a weak mesh dependent seminorm, this is compensated by using a superapproximation property for the main variable (the velocities in Stokes' problem). Author (ESA)

N81-28828# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

A FINITE ELEMENT METHOD FOR PROBLEMS IN PERFECT PLASTICITY USING DISCONTINUOUS TRIAL FUNCTIONS

Claes Johnson and Ridgway Scott 1980 19 p refs

(CTH-80.09-R) Avail: NTIS HC A02/MF A01

A finite element method of displacement type for problems in perfect plasticity is proposed. For simplicity, a stationary problem corresponding to Henky's law is considered. The quasi-static rate problem corresponding to the Prandtl-Reuss' flow rule does not present any serious difficulties and leads to a problem of Henky type at each incremental step. The proposed method is analyzed, considering a polygonal bounded region in the plane. For a given triangulation, a set of piece wise polynomial functions with no continuity requirement on interelement boundaries is defined. The convergence of the method is proved. A numerical example in one-dimensional space is presented. The error between the exact solution and the solution of the discrete problems is tabulated, and the results are discussed. Author (ESA)

N81-28829# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Science.

AN ANALYSIS OF SOME FINITE ELEMENT METHODS FOR ADVECTION-DIFFUSION PROBLEMS

Claes Johnson and Uno Naevert 1980 18 p refs Presented at Conf. on Anal. and Numerical Approaches to Asymptotic Prob. in Anal., Nijmegen, Netherlands, 9-13 Jun.1980

Avail: NTIS HC A02/MF A01

Methods for improving the performance of the Galerkin finite element method when applied to a stationary advection diffusion problem with small diffusion having a nonsmooth solution are described. The first method consists of postprocessing the

usual Galerkin solution by smoothing which increases the accuracy in regions where the exact solution is smooth. Each smoothing step consists of mass matrix multiplication. The second method is the result of applying the usual Galerkin method to a modified advection diffusion problem obtained by adding extra diffusion in the streamline direction and compensating by modifying the right-hand side. Error estimates and results of some numerical experiments are given. Author (ESA)

N81-28830*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SCALED RUNGE-KUTTA ALGORITHMS FOR HANDLING DENSE OUTPUT
Mary Kathleen Horn 11 Mar. 1981 44 p refs Sponsored by NASA Post Doctoral Fellowship and NRC
(NASA-CR-164559; DFVLR-FB-81-13) Avail: NTIS HC A03/MF A01 CSCL 12A

Low order Runge-Kutta algorithms are developed which determine the solution of a system of ordinary differential equations at any point within a given integration step, as well as at the end of each step. The scaled Runge-Kutta methods are designed to be used with existing Runge-Kutta formulas, using the derivative evaluations of these defining algorithms as the core of the system. For a slight increase in computing time, the solution may be generated within the integration step, improving the efficiency of the Runge-Kutta algorithms, since the step length need no longer be severely reduced to coincide with the desired output point. Scaled Runge-Kutta algorithms are presented for orders 3 through 5, along with accuracy comparisons between the defining algorithms and their scaled versions for a test problem. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-28831 California Univ., Berkeley.
STATISITCAL MODELLING OF POPULATION PROCESSES Ph.D. Thesis
Peter Malte Guttorp 1980 63 p
Avail: Univ. Microfilms Order No. 8113053

Some standard models, deterministic and stochastic, of population dynamics are reviewed. The techniques associated with Kalman filtering (including problems of smoothing, identification and robustness) are considered. Consistency is proved and the asymptotic distribution of estimates in some nonlinear least squares problems with dependent errors determined as well as of maximum likelihood estimates for models where the conditional density given the past can be specified. Dissert. Abstr.

N81-28832 California Univ., Berkeley.
ASYMPTOTIC INFERENCE FOR A CLASS OF STOCHASTIC PROCESSES Ph.D. Thesis
Anders Rygh Swensen 1980 118 p
Avail: Univ. Microfilms Order No. 8113205

The families of distributions of dependent observations are locally asymptotically normal. The principal idea is that the conditional likelihood ratios from a martingale. Using some recent results on invariance principles for martingale differences, it is shown in a general context how the likelihood ratio behaves provided an asymptotic negligibility condition is satisfied. Some results on weak convergence of martingale difference which may be of independent interest are proved. Autoregressive dependence is considered. Supercritical branching processes are treated. Dissert. Abstr.

N81-28833 Wisconsin Univ. - Madison.
RANDOM COEFFICIENTS IN LINEAR MODELS Ph.D. Thesis
Richard Henry Jones 1980 309 p
Avail: Univ. Microfilms Order No. 8107031

A geometrical approach to the study of linear models with random coefficients is described. In situations where researchers are able to choose the design vectors for their experiments at will, the fact that projections of the coefficient vectors are observable allows contours of the density function of the random coefficient vectors to be estimated using techniques developed previously for work in X-ray tomography. For cases where it is deemed desirable to assume the coefficient vectors are normally distributed, a method is presented to assess the validity of the normal assumption in such situations. The technique is valid for assessing the normality of any set of random vectors. For disciplines where researchers do not have control over the design vectors of their experiments, e.g., in business and economics, a geometric argument is given to demonstrate that it will often not be possible to obtain accurate estimates of even the second moments of the coefficient vectors' density function let alone its contour of constant density. Dissert. Abstr.

N81-28834 Iowa Univ., Iowa City.
RANK PROCEDURES IN DISCRIMINANT ANALYSIS FOR TWO MORE POPULATIONS Ph.D. Thesis
Tie-Hua Ng 1980 148 p
Avail: Univ. Microfilms Order No. 8114288

When applying the LDF or QDF to non-normal data in two-population forced discrimination problems, the two misclassification probabilities can be very unbalanced. A rank procedure which attempts to balance the two misclassification probabilities is suggested. It is proved that the ratio of the two misclassification probabilities can be controlled asymptotically by using the rank procedures. The rank procedure from two-population problems is extended to multipopulation problems in partial discrimination as well as in forced discrimination. Four different rank procedures are discussed. They are: the Combination Procedure, the Minimum-P Procedure, the Minimum-Distance Procedure and the Minimum-Rank Procedure. Dissert. Abstr.

N81-28835 Florida State Univ., Tallahassee.
AN INVESTIGATION OF THE EFFECT OF THE SWAMPING PHENOMENON SEVERAL BLOCK PROCEDURES FOR MULTIPLE OUTLINES IN UNIVARIATE SAMPLES Ph.D. Thesis
Thomas William Woolley, Jr. 1981 141 p
Avail: Univ. Microfilms Order No. 8113272

Sources of outliers, and various means for dealing with them are discussed. Also presented are general descriptions of univariate outlier tests as well as well as the two approaches to handling multiple outlier situations, consecutive and block testing. Specifically, the susceptibility to swamping of four block procedures for multiple outliers in univariate samples is assessed. Pseudo-random samples are generated from a unit normal distribution, and varying numbers of upper outliers placed in them according to specified criteria. A swamping index is created which reflects the relative vulnerability of each to declare a block of outliers and the most extreme upper non-outlier discordant, as a unit. The results reveal that the four block tests disagree in their respective susceptibilities to swamping depending upon samples size and the prespecified number of outliers assumed to be present. Rank orderings of these four tests based upon their vulnerability to swamping under varying circumstances are presented. In addition, alternate approaches to calculating the swamping index when four or more outliers exist are described. Dissert. Abstr.

N81-28836 California Univ., Berkeley.
TOPICS ON SYSTEMATIC SAMPLING Ph.D. Thesis
Ronaldo Lachan 1980 124 p
Avail: Univ. Microfilms Order No. 8113077

An asymptotic theory for systematic sampling is developed. A general superpopulation model is constructed consisting of the assumption that the population values arise from a second-order stationary process with a mean function superimposed. Asymptotic normality of the sample mean is obtained for both single random start systematic sampling and for multiple random start systematic sampling, when both the population size and the sample size are allowed grow to infinity by keeping their ratio constant. The asymptotic variance is shown to be equal to the limiting expected variance. A comparison among the various multiple random start systematic sampling schemes--including random start systematic sampling and simple random sampling--is made in terms of the asymptotic expected variances of the corresponding sample means. The asymptotic behavior of

some variance estimators and of confidence intervals based on them are examined. Dissert. Abstr.

N81-28837 Oklahoma State Univ., Stillwater.
BAYESIAN INFERENCE FOR THE VARIANCE COMPONENTS IN MIXED LINEAR MODELS Ph.D. Thesis
Muthiya Rajagopalan 1980 56 p
Avail: Univ. Microfilms Order No. 8113330

Mixed linear models are investigated using Bayesian techniques for making inferences about the variance components in the model. The marginal posterior distributions of the variance components is of primary interest. Gamma priors for the precision components and uniform priors for the fixed effects are used. The conditional posterior distribution of the variance components, conditional on the random effects, are gamma distributions and that of the fixed effects is a multivariate distribution. Since the marginal posterior distributions of the variance components are analytically intractable, using the multivariate normal approximation to the multivariate t, approximations are obtained for the posterior marginal distributions of the variance components in infinite series form. Further, closed expressions for the moments of these distributions are also derived. Numerical studies show that the approximations are good. The accuracy of these approximations increase with the alpha parameter. The posterior distribution of the within variance component is less sensitive to variations in the prior parameters than that of the others. When there is little prior information it seems appropriate to choose the alpha parameter around 2. Dissert. Abstr.

N81-28838 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STOCHASTIC ASPECTS OF CLIMATIC TRANSITIONS ADDITIVE FLUCTUATIONS
C. Nicolis and G. Nicolis 1980 36 p refs Submitted for publication Sponsored in part by Inst. Internatinale de Physique et de Chemistry
(Aeronomica-Acta-A-223-1980) Avail: Issuing Activity

The Fokker-Planck equation, corresponding to a zero-dimensional climatic model showing bistable behavior, is analyzed. A climatic potential function is introduced, whose variational properties determine the most porbable states of the stationary probability distribution. Both the static and the time dependent properties of the fluctuations are monitored by two basic quantities: (1) the climatic potential, U, and (2) the variance of the noise. A sensitivity analysis of U with respect to system parameters, particularly the temperature feedback coefficient, shows a distinction between a regime where present climate dominates and a regime where a deep freeze climate dominates. Conditions of coexistence of these two regimes in terms of the characteristic parameters were also determined. For small variance, the stationary probability distribution is very sharply peaked around the dominant state while the time scale of evolution becomes exceedingly slow. Moreover, an increase in the temperature feeddback coefficient tends to favor the deep freeze climate.
Author (ESA)

N81-28839# Stanford Univ., Calif. Dept. of Operations Research.
SIMULATION OUTPUT ANALYSIS FOR GENERAL STATE MARKOV CHAINS
Peter W. Glynn and Donald L. Iglehart Feb. 1981 21 p refs (Contract N00014-76-C-0578; Grant NSF MCS-79-09139)
(AD-A100505; TR-54) Avail: NTIS HC A02/MF A01 CSCL 12/1

Discrete events simulations can be modeled by generalized semi-Markov processes (GSMP's). Our goal is to estimate characteristics of the stationary distribution of a GSMP. A GSMP viewed at the embedded jump points is a general state space Markov chain (GSSMC). The regenerative method for denumerable state Markov chains does not apply since a GSSMC in general does not hit a single state infinitely often. Three approaches to this problem are discussed. The first is based on a recent construction of regeneration times for GSSMC's developed by Athreya/Ney and Nummelin. This construction can also be used to increase the frequency of regeneration points for Markov chains with a denumerable state space. The second approach decomposes the GSSMC at the hitting times of a specified set. This decomposition leads to a Doeblin recurrent Markov chain and an associated central limit theorem. The third approach involves fitting multidimensional autoregressive and autoregressive-moving average models to the GSSMC using the state space approach to time series. An example to illustrate the three approaches is discussed. Author (GRA)

N81-28840# Wisconsin Univ. - Madison. Mathematics Research Center.
THE ROBUST DESIGN OF EXPERIMENTS: A REVIEW Technical Summary Report
Agnes M. Herzberg (Imperial Coll. of Science and Technology) May 1981 17 p refs
(Contract DAAG29-80-C-0041)
(AD-A100561; MRC-TSR-2218) Avail: NTIS HC A02/MF A01 CSCL 12/1

A review of several optimality criteria for the design of experiments involving quantitative factors for the estimation of unknown parameters in regression problems is given. These include rotatability, D-optimality and G-optimality criteria. Designs are no longer optimal under these criteria when conditions are suboptimal. The two main lines of research in the robust design of experiments will be discussed, i.e., the comparison of the performance of an optimal design with respect to a particular criterion under other criteria, and the construction of designs which guard against particular short comings. Author (GRA)

N81-28841# Wisconsin Univ. - Madison. Mathematics Research Center.
REPRESENTATIONS OF THE SPACE OF DISTRIBUTIONS IN ROBUST ESTIMATION OF LOCATION Technical Summary Report
David L. Hall (Battelle Northwest Labs., Richland, Wash.) and Brian L. Joiner May 1981 14 p refs
(Contract DAAG29-80-C-0041)
(AD-A100562; MRC-TSR-2219) Avail: NTIS HC A02/MF A01 CSCL 12/1

In many situations it is useful to have a low-dimensional representation of the space of distributions. In this report, one, two and three dimensional representations are given which are of particular relevance to the study of robust estimation of location based on rank estimators. The distances are defined as functions of the asymptotic relative efficiency of the most efficient rank estimator for one distribution when used on data from another distribution. Values of these distance functions are computed for a large number of pairs of distributions and multidimensional scaling is used to find the low-dimensional representations.
Author (GRA)

N81-28842# Old Dominion Univ., Norfolk, Va. Dept. of Mathematics Sciences.
MINIMAX LINEAR REGRESSION ESTIMATORS WITH APPLICATION TO RIDGE REGRESSION Final Report
Lawrence C. Peele and Thomas P. Ryan May 1980 28 p refs
(Contract F49620-79-C-0125; AF Proj. 2304)
(AD-A100146; AFOSR-80-1092TR; TR-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

This work examined minimax linear estimation in multiple linear regression. The application of minimax estimation to regression led to the development of ridge regression estimators with stochastic ridge parameters. These estimators were seen to be invariant under linear transformation; a property which has not been established for other ridge estimators. These minimax-motivated estimators were examined in several simulation studies. In particular, flaws in other simulation studies of ridge estimators were depicted. Consequently, an improved simulation procedure was used. It was observed from these studies that, contrary to published statements, a ridge estimator can be considerably superior to the ordinary least squares estimator, especially when high pairwise correlations exist among the regression variables. Robustness considerations were used to suggest a requirement that a 'good' generalized ridge regression estimator should satisfy. Author (GRA)

N81-28843# Oak Ridge National Lab., Tenn. Environmental Services Div.
INDUCTIVE MODELING OF TIME SERIES: A DETRENDING APPROACH
B. L. Kirk and B. W. Rust 1981 8 p refs Presented at the

Environmetrics 1981 Conf., Washington, D.C., 6 Apr. 1981
(Contract W-7405-eng-26; Grant NSF DEB-77-26722)
(CONF-810436-1) Avail: NTIS HC A02/MF A01

The mathematical behavior of time series is addressed. Spectral analysis (either Fourier amplitude spectrum analysis of maximum entropy spectral analysis) may aid in detecting cyclic trends in data, but trends are not necessarily cyclic. A code was developed that strips a time series of tis trend. This trend may be a polynomial, an exponential, an autoregressive term, a sinusoid, a combination of these, or some other mathematical expression. As an illustration of the method describe above, a time series that possesses very obvious trends is studied. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-28844# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

THREE DIMENSIONAL OPTIMAL PURSUIT AND EVASION WITH BOUNDED CONTROLS

J. Shinar and S. Gutman Nov. 1979 31 p refs
(Contract F49620-79-C-0135)
(TAE-381) Avail: NTIS HC A03/MF A01

The missile-aircraft pursuit-evasion problem is formulated by a three-dimensional linearized kinematic model with bounded control. The formulation is valid both for the optimal control (against a known adversary strategy) and the zero sum differential game versions. Assuming perfect information the linearized kinematic model yields for both versions a solution which can be implemented in real-time for airborne application. The avoidance of a known pursuer by an evader who has no state information is solved by a stochastically optimal periodical maneuver. Other examples of imperfect information are briefly discussed. Author

N81-28845# Texas Univ. at Arlington. Center for Cybernetic Studies.

A NOTE ON SPECIALIZED VERSUS UNSPECIALIZED METHODS FOR MAXIMUM FLOW PROBLEMS

Fred Glover (Colorado Univ., Boulder), Darwin Klingman, and Melissa Mead Mar. 1981 10 p refs
(Contracts N00014-81-C-0236; DOT-OST-70074)
(AD-A100459; CCS-395) Avail: NTIS HC A02/MF A01 CSCL 12/2

A study developing highly efficient versions of both primal simplex and labeling methods for maximum flow problems has disclosed the surprising superiority of specialized primal methods. These provocative findings not only overturn standard expectation about the relative performance of simplex versus labeling approaches, but also raise the intriguing question of whether - or to what extent - it is useful to develop specialized methods for maximum flow problems. This issue was investigated by testing both specialized and unspecialized primal simplex codes on the same maximum flow problems using the same computer and compiler. Considering the possibility that some general primal network codes may be better tuned to maximum flow applications than others, a code was obtained which was timed for maximum flow problems in terms of using a special tree orientation, pricing subroutine, and pivot selection subroutine. The specialized primal code used in the tests is the SEQCS code. Hereafter it is, respectively, refer to these codes as GENERAL and SPECIAL. The tests of the two methods were conducted on four types of network structures: random (R), multi-terminal random (MR), transit grid (TG), and hard (H). It is found after testing 185 maximum flow problems embodying these diverse structures that the SPECIAL code is substantially more efficient than GENERAL, in spite of th fact that GENERAL was demonstrated superior to the specialized maximum flow procedures it was previously tested against. The R problems were generated by randomly selecting ordered node pairs to identify the arcs (avoiding duplication), and these were in turn randomly assigned capacities from a predefined interval. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-28846# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.

EMISSION OF PARTICLES FROM A CHARGED SPHERE INTO A MAGNETIC FIELD, PART 2 Scientific Interim Report

Christopher Sherman 26 Jan. 1981 12 p
(AF Proj. 7661)
(AD-A100268; AFGL-TR-81-0020; AFGL-ERP-725) Avail: NTIS HC A02/MF A01 CSCL 20/3

Trajectories of particles emitted normally from a charged sphere into a constant magnetic field are examined. Corrections are made to previous calculations which led to the separation of such trajectories into two classes, those which return to the sphere and those which do not. Author (GRA)

N81-28847# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.

THE MASLOV METHOD AND THE ASYMPTOTIC FOURIER TRANSFORM: CAUSTIC ANALYSIS

Richard W. Ziolkowski and Georges A. Deschamps Sep. 1980 450 p refs
(Grant NSF ENG-77-20820)
(PB81-176711; UIEL-80-9; UILU-ENG-80-2552; NSF/RA-800431) Avail: NTIS HC A19/MF A01 CSCL 20C

A systematic approach, due to Maslov, which consists essentially of operating in the phase-space M (position-wavevector) instead of the space X (position) is presented. An integral representation is described that may be evaluated numerically, analytically, or by applying known techniques to obtain a uniform asymptotic expression. A generalization of the procedures, known as the GO-AFT approach, is explained wich circumvents the phase space description. To illustrate this approach, it is applied to a general homogeneous medium problem (one involving a cusp caustic) and to a general linear-layer problem (a plane wave incident on a linear layer). Problems concerning indirect and direct asymptotics and caustics in the presence of a diffracting half-plane are also considered. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-28848 Columbia Univ., New York.

THREE DIMENSIONAL EXPRIMENTAL STUDY OF ACOUSTIC ELASTIC WAVE SCATTERING AND DIFFRACTION Ph.D. Thesis

Charles Edward Shepherd 1981 81 p
Avail: Univ. Microfilms Order No. 8113559

Three dimensional model experiments are performed to study the acoustic elastic wave scattering and diffraction by a vertical elastic cylinder immersed in a fluid due to a transient acoustic point source. The direct, tansmitted and diffracted waves in the volume exterior to the cylinder are clearly observed. Particularly, the diffracted longitudinal transverse. Rayleigh, and acoustic (creeping) waves which propagate near the cylindrical interface are observed together with the waves transmitted through the cylinder. The movement of the diffracted waves for nonsymmetric source receiver configurations is shown. Splitting of each

diffraction at nonsymmetry receiver positions is verified and explained as a result of diffracted energy propagating in both directions around the cylinder. Helical diffracted waves propagating up and down the cylinder, as predicted by theory, are verified. Three dimensional ray path and wavefront equations are given for all of the waves encountered in this experiment. The amplitude spectra maxima events observed on the data trace.
Dissert. Abstr.

N81-28849 Columbia Univ., New York.
NOISE TRANSMISSION THROUGH STIFFENED CURVED PANELS Ph.D. Thesis
Min-Tsong Chang 1981 73 p
Avail: Univ. Microfilms Order No. 8113495

The theory and solution of sound transmission into a semicylindrical enclosure through an elastic discreetly stiffened curved panel are presented. The transmitted sound is calculated by solving the coupled acoustic-structural equations using a modal analysis. The modes and the natural frequencies of the curved stiffened panels are estimated by the finite element-strip method while the acoustic modes are those of a semicylindrical enclosure. Numerical results include spectra of the interior sound pressure due to white noise, turbulent boundary layer and propeller noise inputs. Dissert. Abstr.

N81-28850 Purdue Univ., Lafayette, Ind.
LINEAR AND NONLINEAR CHARACTERISTICS AND APPLICATIONS OF SURFACE ACOUSTIC WAVE RESONATORS Ph.D. Thesis
Michael Evert Field 1980 154 p
Avail: Univ. Microfilms Order No. 8113678

Two applications of a four port device are considered in conjunction with external circuit elements to provide unusual characteristics. A regenerative active resonator was developed which exhibits electronically variable Q and tunability. A bandpass filter at 34 MHz was produced which achieves a loaded Q in excess of 30,000 and a peak to background ratio exceeding 50 dB. In addition, the device exhibits in insertion gain of 18 dB. Electronic model selection is observed. Bistability and hysteresis are demonstrated in a similar device. The device also exhibits a hysteresis in its frequency response. A computer program is developed to model a rather general SAW device usings Mason equivalent circuits. Additional provision is made to implement the effects of random variations of the equivalent circuit elements by Monte-Carlo approach. Of particular interest are random variations of the positions of the electrode edges due to the inherent inaccuracies of photomask generating equipment. In addition, the effect of such random errors on interdigital transducers is investigated. Dissert. Abstr.

N81-28851 State Univ. of New York at Buffalo.
SONIC AGGLOMERATION OF AMMONIUM CHLORIDE AEROSOLS IN INTENSE SOUND FIELDS Ph.D. Thesis
Man-Ting Cheng 1981 191 p
Avail: Univ. Microfilms Order No. 8114657

Acoustic coagulations were studied under traveling-wave conditions with the sonic intensity levels ranging from 145 to 1556 dB and frequencies from 600 to 3000 Hz. The aerosols used ammonium chloride with mass concentrations of 2-20 gm/cm/and sizes from 0.06 to 35 micrometers. Experimental results show a bimodal mass distribution for the acoustically agglomerated particles. The agglomeration increases with the sonic frequency, the intensity, the particle size and the mass loading. The acoustic kernels were numerically evaluated scheme was developed, tested, and used to calculate the mass distribution of the acoustically agglomerated particles. A comparison of the experiment with theory shows that the orthokinetic interaction is the dominant mechanism under all the experimental conditions in this study. When the total number of coarse particles (collectors) is small, the measured mass distributions of the agglomerated particles are in good agreement with the numerical calculation. Once the number of collectors becomes large, the experimental data is lower than that as calculated by the theory.
Dissert. Abstr.

N81-28852 California Univ., Santa Barbara.
COMPUTER SIMULATION OF SOUND FIELDS USING RAY METHODS Ph.D. Thesis
James Lewis Wayman 1980 103 p
Avail: Univ. Microfilms Order No. 8114228

A computer simulation model for calculating energy distributions and point pressures in steady state and time varying acoustic fields is presented. The model is based on the conventional ray theory of acoustics. Point pressures are calculated by modifying the model to consider phase relationships between the various direct and reflected rays. Verification is obtained through applications of the model to one dimensional standing waves, free field conditions around a spherically symmetric source, reverberant decay in a room, and enclosed field response to a frequency varying sound source. Simulation results are compared to theoretical and experimental findings and are found to be similar statistically. Algorithms for application to nonrectangular enclosures are presented. The model appears to be a valid, practical tool for the design and analysis of acoustic field and may have applicability in a variety of engineering problems. Dissert. Abstr.

N81-28853 Maine Univ., Orono.
A COMPRESSIBLE FLUID TREATMENT OF ACOUSTIC STREAMING NEAR AND STRESSES ON SPHERICAL OBSTACLES Ph.D. Thesis
Mark Lee Bundy 1980 199 p
Avail: Univ. Microfilms Order No. 8115329

A treatment for traveling waves is discussed which considers compressibility by keeping terms of order a/lambda in the equations. It is shown that for a/lambda < 1/250 in water for frequency v = 1MHz(1/400 in air for v = .2kHz) the streaming pattern for a traveling wave is essentially the same as that for a standing wave of the wavelength using incompressible theory. In contrast to standing wave patterns, the compressible theory for traveling waves predicts that for a/lambda greater than 1/250 at 1MHZ the vortex motion disappears in an asymmetric fashion. Theory on streaming induced surface stress on a sphere is also presented. An expression for stress as a function of angle over the spheres nonslip surface is derived. Dissert. Abstr.

N81-28854# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ASSESSMENT AND PROPAGATION OF NOISE FROM CONVENTIONAL AND QUIET PILE DRIVERS
H. S. Gill Sep. 1980 182 p refs
(ISVR-TR-110) Avail: NTIS HC A09/MF A01

Noise levels, spectra and waveform shapes of noise from commercial pile drivers were studied. Noise propagation characteristics and the effects of interposition of a barrier were also examined. The analog data were analyzed digitally to examine pressure waveforms and sound pressure level time histories. Noise reduction techniques employed by each manufacturer are described. Equivalent sound levels 20 to 40 dB (A) are generated by the extensively treated piling rigs as compared with the conventional untreated piling rigs. The overall A weighted equivalent sound levels from pile drivers attenuate with a rate of approximately 7.1 dB (A) per doubling of distance from the source. The effect of barriers upon the reduction of piling noise can be reasonably predicted by the use of simple barrier theories. The unobstructed propagation of impulsive noise over real ground surfaces does not appear to have significant effect in changing the character of the impulsive sound. This observation also applies when the sound from such a source propagates over the low barriers. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-28855 Purdue Univ., Lafayette, Ind.
INVESTIGATIONS OF TRANSPORT AND STRUCTURAL PROPERTIES OF CONDENSED PHASE SYSTEMS BY THE METHOD OF MOLECULAR DYNAMICS Ph.D. Thesis
Phillip Allen Cheeseman 1980 389 p
Avail: Univ. Microfilms Order No. 8113654

A brief description of the Molecular Dynamics simulation method (Md), a review of MD studies of systems having MX2

and MX4 stoichoimetries, and finally a report of results obtained from simulation studies of modeled NaMgF3 and MgSiC3 cubic perovskite structures are presented. The studies of the ABX3 fluoride and silicate, undertaken to assess the possibility of superionic conductivity in the silicate, indicate no ion transport to occur in the perfect structure near the material's melting point. Two types of trial defects installed in both simulated compounds, however, appear to give rise to anionic diffusion corresponding to a superionic conductor. These are interchange of approximately 20% of the structure's cations within their unit cells and production of 11% AX vacancy pairs. A further conclusion is drawn that NaMgF3 and MgSiO3 may only be analogous w.r.t. anion transport in qualitative terms since the relative anion diffusivities between defect types were seen to behave differently for the fluoride and silicate. Dissert. Abstr.

N81-28856 Pennsylvania State Univ., University Park.
A KINETIC STEADY-STATE MODEL FOR THE EXCITATION OF HELIUM ATOMS IN LOW PRESSURE, MICROWAVE INDUCED DISCHARGES Ph.D. Thesis
Christopher Kevin Kohlmiller 1981 138 p
Avail: Univ. Microfilms Order No. 8112818

A kinetic steady state model is theorized to predict the population density of excited atoms in reduced pressure helium discharges. This model assumes inelastic electron-impact excitations and radiative cascading from higher states as the population processes and radiative deactivation and associative ionization as the depopulation processes. The electron energy was experimentally determined by a double probe method to allow the evaluation of the rate constants of the electron impact excitation reactions from known cross sections. The electron number density was also determined and was assumed to fit a Druyvesteyn energy distribution. The relative population densities of the excited states of helium in a microwave induced discharge were measured and compared with the calculated results. The densities of the excited states in doped discharges were also measured. Dissert. Abstr.

N81-28857 Princeton Univ., N. J.
REACTIONS OF ATOMIC HYDROGEN AND ITS ISOTOPES IN THE BOUND STATE Ph.D. Thesis
Peter Gerhart Debuda 1981 313 p
Avail: Univ. Microfilms Order No. 8114618

Tunneling of hydrogen and deuterium atoms in condensed phase reactions were investigated. Condensed phase reactions are qualitatively different from gas phase reactions, because in condensed phase reactions both the reactant and the product may be modeled as bound species. Therefore, reaction conditions are more favorable for quantum mechanical tunneling than they would be in gas phase reactions. The tunneling process is modeled by a Schroedinger wave equation with a potential function which is a function of the positions of the atoms which are tunneling simultaneously. The potential function has two minima, which model the reactant and the product. These two minima can either be copies of each other (the symmetric case) or they can be different, i.e., have different depths, different widths, and different shapes (the symmetric case). Dissert. Abstr.

N81-28858 Rochester Univ., N. Y.
STOCHASTIC THEORY OF NEAR RESONANT ATOM-RADIATION INTERACTIONS Ph.D. Thesis
Jen-Jye Yeh 1980 152 p
Avail: Univ. Microfilms Order No. 8114144

Numeric and approximate analytic methods to study the bandwidth effects of a partially coherent laser on near-resonant atomic transitions are presented. From a fully quantum mechanical formulation for near-resonant atom-photon interactions, the stochastic interpretation of the corresponding quantum Bloch equations is derived. Based on the resulting stochastic atomic density matrix equations, two different stochastic models of the laser field are studied: a continuous Markovian model and a discontinuous Markovian model. The Ornstein-Uhlenbeck random phase model is used to investigate the effects on multiphoton ionization and stationary Raman gain, in particular, of finite bandwidth and non-Lorentzian bandshape of th incident laser field. The stationary and Markovian properties of general jump processes which are typical discontinuous processes are studied and a stationary Markovian jump process is applied to near resonant optical saturation problems. A direct computer simulation is designed to calculate time-dependent average atomic populations. The extra relaxation enhancement due to amplitude fluctuations is discussed. Dissert. Abstr.

N81-28859 Rochester Univ., N. Y.
CROSSED BEAM STUDIES OF ION-MOLECULE REACTIONS Ph.D. Thesis
Robert Michael Bilotta 1980 294 p
Avail: Univ. Microfilms Order No. 8114126

Velocity distribution of the ionic product from low energy proton and electron transfer reactions of H2(+) with CO, Ar, H2O, and Ne are obtained using a crossed beam apparatus possessing the capability of investigating low energy ion-molecule rections in which a light ion interacts with a heavy neutral. Dissert. Abstr.

N81-28860 Columbia Univ., New York.
THE QUENCHING COLLISION IN THE CASCADES OF MESONIC HYDROGEN Ph.D. Thesis
David Chang 1981 346 p
Avail: Univ. Microfilms Order No. 8113494

The quenching collision is proposed as a de-excitation process in the cascades of mesonic hydrogen for states whose atomic radi are less than or of the order of the electron Bohr radius. In this collison with a normal target, part of the mesonic atom's internal excitation is converted into the final kinetic energies of the mesonic atom and the target in their center of mass system. Thus the final mesonic atom kinetic energy in the laboratory is substantial, and the quenching collision, unlike the other process usually considered in the these cascades, results in hot mesonic atoms, heating the mesonic atom subgas. Dissert. Abstr.

N81-28861 California Univ., Berkeley.
PHOTOELECTRON PHOTOION MOLECULAR BEAM SPECTROSCOPY Ph.D. Thesis
Dennis James Trevor 1980 159 p
Avail: Univ. Microfilms Order No. 8113215

The use of supersonic molecular beams in photoionization mass spectroscopy and photoelectron spectroscopy to assist in the understanding of photoexcitation in the vacuum ultraviolet is described. Rotational relaxation and condensation due to supersonic expansion were shown to offer possibilities for molecular photoionization studies. Molecular beam photoionization mass spectroscopy was extended above 21 eV photon energy by the use of Stanford Synchrotron Radiation Laboratory facilities. Design considerations are discussed that have advanced the state of the art in high resolution VUV photoelectron spectroscopy. In order to extend gas phase studies to 160 eV photon energy, a windowless VUV-XUV beam line design is proposed. Dissert. Abstr.

N81-28862 Columbia Univ., New York.
INFRARED ABSORPTION BANDS OF ALKALI SATURATED VAPORS Ph.D. Thesis
Andrew Vasilakis 1981 96 p
Avail: Univ. Microfilms Order No. 8113566

A region of absorption was observed and measured in the near infrared region of the spectrum for saturated sodium vapor and for saturated rubidium vapor (absorption beyond 0.83 microns for saturated sodium vapor, and beyond 1.20 microns in rubidium saturated vapor). In addition, earlier data taken on near infrared absorption by cesium saturated vapor beyond 1.30 microns was reexamined in another set of experiments and found to have some differences with the newer data. Comparisons are made for similar regions of infrared absorption in the different alkalies. The origins of the absorption bands observed in the near infrared are not known with certainty. However, it is most likely that alkali dimers in the repulsive x(3)sigma sub u(-) state and higher polymers are responsible for the absorption in this report. Attempts were also made to observe the discovered bands in emission using the techniques of laser induced fluorescence in saturated sodium and cesium vapors. Dissert. Abstr.

N81-28863 Minnesota Univ., Minneapolis.
CHEMICAL DYNAMICS OF ION-ATOM COLLISIONS: A MERGED MOLECULAR BEAM STUDY Ph.D. Thesis
George Francis Schuette 1981 196 p

Avail: Univ. Microfilms Order No. 8115038

Reactive scattering in D2(+)+C and D2(+)+F(2P) collisions was studied using the merged molecular beam technique. Absolute reaction cross sections and product ion energy distributions were measured for the reactions D2(-) + C yields CD(+) + D(I) and D2(+) + F(2P) yields FD(+) + D(II) over the collision energy range 0.003 to 20 eV. The cross sections for reactions I and II over the range 0.003 to 0.1 eV were compared to capture cross sections calculated for the long-range interaction of a positive ion with C(3P) and F(2P) atoms, respectively. Deconvolution of the product ion energy distributions for reaction I over the range 0.1 to 2 eV indicate the CD(+) product is formed near its dissociation limit. Structure in the energy dependence of the cross section and the product energy distributions for reaction II above 3 eV indicate two product channels are energetically accessible, corresponding to formation of FD(+) in the (2)II and 2 sigma electronic states. Fragment laboratory kinetic energy spectra were measured for the dissociation of D5(+), NH3(+2) and CS2(+3) excited in low-momentum transfer collisions at kV energies with inert gas targets. Dissert. Abstr.

N81-28864 Kansas State Univ., Manhattan.
SYSTEMATICS OF SINGLE AND DOUBLE K-SHELL VACANCY PRODUCTION IN TITANIUM BOMBARDED BY HEAVY IONS Ph.D. Thesis
James Marion Hall 1981 174 p
Avail: Univ. Microfilms Order No. 8114062

The systematics of single and double K-shell vacancy production in Titanium was investigated in the limit of zero target thickness for incident C, N, O, F, Mg, Al, Si, S, and Cl ions over a maximum energy range of 0.5 to 6.5 MeV/amu. This corresponds to collision systems with 0.24 < v sub1/v sub 2k < 0.85 and 0.27 < Z sub 1/Z sub 2 < 0.77. Single K-shell ionization were investigated by measuring K and K satellite X-ray production cross sections for projectiles incident with no K-shell vacancies. Single K-shell to K-shell electron transfer cross sections were obtained indirectly by measuring the enhancement in the Ti K X-ray production cross section for bare incident projectiles over ions incident with no initial K-shell vacancies. Double K-shell ionization was investigated by measuring the K alpha hypersatellite intensity in ratio to the total K alpha intensity. Double K-shell to K-shell electron transfer cross sections were obtained indirectly using a difference procedure similar to that used for single K to K transfer. Dissert. Abstr.

N81-28865 California Univ., Berkeley.
MEASUREMENT OF THE PARITY NONCONSERVING NEUTRAL WEAK INTERACTION IN ATOMIC THALLIUM Ph.D. Thesis
Philip Howard Bucksbaum 1980 213 p
Avail: Univ. Microfilms Order No. 8112977

An experiment to measure parity nonconservation in atomic thallium is described. A frequency doubled flashlamp pumped turnable dye laser is used to excite the 6P sub 1/2 F = 0) yields 7P sub 1/2 (F = 1) transition at 292.7 nm, with circularly polarized light. An electrostatic field E of 100-300 V/cm causes this transition to occur via Stark induced electric dipole. Two field free transitions may also occur: a highly forbidden magnetic dipole M, and a parity nonconserving electric dipole xi sub p. The latter is presumed to be due to the presence of a weak neutral current interaction between the 6p valence electron and the nucleus, as predicted by gauge theories which unite the electromagnetic and weak interactions. Both M and xi sub p interfere with the Stark amplitude beta E to produce a polarization of the 7P sub 1/2 state. This is measured with a circularly polarized infrared laser beam probe, tuned to the 7P sub 1/2 yields 8S sub 1/2 transition. A preliminary measurement yielded a parity violation in agreement with the gauge theory of Weinberg and Salam. Dissert. Abstr.

N81-28866# Princeton Univ., N. J. Elementary Particles Lab.
CHARM PRODUCTION BY MUONS AND ITS ROLE IN SCALE-NONVARIANCE Ph.D. Thesis
George D. Gollin Jan. 1981 257 p refs
(Contract DE-AC02-76ER-03072)
(DOE/ER-03072/T3) Avail: NTIS HC A12/MF A01

Interactions of 209 GeV muons in the Multimuon Spectrometer at Fermilab yielded more than 80,000 events with two muons in the final state. After reconstruction and cuts, the data contain 20,072 events with (81 + or - 10) percent attributed to the diffractive production of charmed states decaying to muons. The cross section for diffractive charm muoproduction is 6.9(+1.9,-1.4) nb where the error includes systematic uncertainties. By extrapolation, the effective cross section for 178 (100) GeV photons is 750(+180,-130)(560(+200,-120)) nb and the parameter lambda is 3.3 + or - 0.2(1.9 + or - 0.2) GeV/c. The nu dependence of the cross section is similar to that of the photon-gluon-fusion model. A first determination of the structure function for diffractive charm production indicates that charm accounts for approximately 1/3 of the scale-noninvariance observed in inclusive muon-nucleon scattering at low Bjorken x. Okubo-Zweig-Iweig-Lizuka selection rules and unitarity allow the muon data to set a 90 percent confidence lower limit on the psi N total cross section of 0.9 mb. DOE

N81-28867# Argonne National Lab., Ill. High Energy Physics Div.
QCD CORRECTIONS TO QUARKONIA DECAYS
William Celmaster Aug. 1980 13 p refs Presented at the 20th Intern. Conf. on High Energy Physics, Madison, Wis., 16-23 Jul. 1980
(Contract W-31-109-eng-38)
(ANL-HEP-CP-80-60; CONF-800724-73) Avail: NTIS HC A02/MF A01

A summary is given of recent work done on QCD corrections to incusive leptonic and hadronic decays of quarkonia. Particular attention is given to the decays psi yields e(+)e(-) and n sub Q yields hadrons. DOE

N81-28868# Ohio State Univ., Columbus. Dept. of Physics.
NEUTRINO MIXING IN A GRAND UNIFIED THEORY
K. Milton 1980 6 p refs
(Contract DE-AC02-16ER-01545)
(DOE/ER-01545/289) Avail: NTIS HC A02/MF A01

The neutrino mass matrix was determined by the Gell-Mann-Ramond-Slansky mechanism. With an arbitrary real right-handed Majorana mass matrix which incorporates three neutrino mass scales, the effects of the up-quark mass matrix are found to be dominant and as a result no significant mixing of nu/sub e/ occurs, while nu/sub mu/ -nu/sub gamma/ mixing can be substantial. DOE

N81-28869# Saint Bonaventure Univ., N.Y.
PION-NUCLEAR PARTIAL WAVE ANALYSIS AND STUDY OF BARYON STRUCTURE Progress Report, 1 Jun. 1979 - 31 May 1981
R. E. Hendrick 10 Jan. 1981 21 p refs
(Contract DE-AC02-79ER-10402)
(DOE/ER-10402/T1) Avail: NTIS HC A02/MF A01

This report details progress toward completion of a long term pion nucleon partial wave analysis, summarizing results and conclusions to date. Progress in using partial wave and resonance parameter results to test dynamical models of the baryon and in better understanding interquark forces within baryon is discussed. DOE

N81-28870# Ames Lab., Iowa.
STUDY OF DIFFERENT FORMS FOR THE RECOMBINATION FUNCTION IN THE FORMATION OF MESONS FROM PARTONS M.S. Thesis
Gerhard Groessing 1980 56 p refs
(Contract W-7405-eng-82)
(IS-T-929) Avail: NTIS HC A04/MF A01

The form of the recombination function-R is varied phenomenologically, and moment solutions are given for the fragmentation function implied by these different R-functions. The fragmentation functions calculated from their moments by the moment inversion method of Yndurain are represented. A description is given of the quark recombination model, and choices are mentioned for the recombination function in meson production, introducing an expression for R and giving a general moment solution for the fragmentation function. DOE

N81-28871# Brown Univ., Providence, R. I. Dept. of Physics.
COMPARING O(N) AND SU(N) x SU(N) SPIN SYSTEMS

IN 1 + 1 DIMENSIONS TO SU(N) GAUGE THEORIES IN 3 + 1 DIMENSIONS

J. Shigemitsu, J. B. Kogut (Illinois Univ., Urbana), and D. K. Sinclair (Illinois Univ., Urbana) Dec. 1980 16 p refs
(Contract DE-AC02-76ER-03130; Grant NSF PHY-79-00272)
(DOE/ER-03130/T1) Avail: NTIS HC A02/MF A01

The scale breaking Lambda parameters of the Euclidean and Hamiltonian formulations of the lattice regulated O(N) and SU(N) x SU(N) spin systems in 1 + 1 dimensions were computed in terms of the Lambda sub Rho Lambda parameter of the Pauli-Villars regulated continuum models. Using lattice perturbation theory, the renormalized mass gap was determined in terms of Lambda sub Rho Lambda for each model. These results are compared to analogous calculations in SU(:nN) gauge theories. DOE

N81-28872# Brown Univ., Providence, R. I. Dept. of Physics.

STUDY OF LAMBDA HYPERON PARAMETERS AND CROSSOVER PHENOMENA IN SU(N) x SU(N) SIGMA MODELS IN TWO DIMENSIONS

J. Shigemitsu and J. B. Kogut (Illinois Univ., Urbana) 1981 82 p refs
(Contract DE-AC02-76ER-03130; Grant NSF PHY-79-00272)
(DOE/ER-03130/T2) Avail: NTIS HC A05/MF A01

The spin system analogues of recent studies of the string tension and lambda parameters of SU(N) gauge theories in 4 dimensions are carried out for the SU(N) x SU(N) and O(N) models in 2 dimensions. The relations between the lambda parameters of both the Euclidean and Hamiltonian formulation of the lattice models and he lambda parameter of the continuum models are obtained. The one loop finite renormalization of the speed of light in the lattice Hamiltonian formulations of the O(N) and SU(N) x SU(N) models is calculated. Strong coupling calculations of the mass gaps of these spin models are done for all N and the constants of proportionally between the gap and the lambda parameter of the continuum models are obtained. These results are contrasted with similar calculations for the SU(N) gauge models in 3 + 1 dimensions. The numerical results suggest that the crossover from weak to strong coupling in the lattice O(N) models becomes less abrupt as N increases while the crossover for the SU(N) x SU(N) models becomes more abrupt. DOE

N81-28873# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.

NUCLEAR SPECTROSCOPIC STUDIES Progress Report, 1 Jun. 1980 - 31 May 1981

C. R. Bingham, L. L. Riedinger, and M. W. Guidry 1 Mar. 1981 48 p refs
(Contract DE-AS05-76ER-04936)
(DOE/ER-04936/6) Avail: NTIS HC A03/MF A01

Research in nuclear spectroscopy at University of Tennessee from June 1980 through May 1981 is summarized. Topics covered include: radioactive decay studies; high spin states; inelastic scattering and reactions of heavy ions from deformed nuclei; and nuclear structure theory. DOE

N81-28874# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.

DEVELOPMENT OF MULTIAMPERE NEGATIVE ION SOURCES

J. Alessi, A. Hershcovitch, K. Prelec, and T. Sluyters 1981 3 p refs Presented at the 1981 Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(Contract DE-AC02-76CH-00016)
(BNL-29159; CONF-810314-73) Avail: NTIS HC A02/MF A01

The Neutral Beam Development Group at BNL is developing H(-)/D(-) surface plasma sources as part of a high energy neutral beam injector. Uncooled Penning and magnetron sources have operated at a maximum beam current of 1 A and a maximum pulse length of 200 ms. A magnetron source with focusing grooves on the cathode and an asymmetric anode cathode geometry operates at a power efficiency of 8 kW/A and a 6% gas efficiency. As the next step, a water cooled magnetron designed to give a steady state beam of 1 to 2 A, was constructed. Experiments are in progress to test a modification of the magnetron which may significantly improve its performance. By injecting a sheet of plasma produced by a highly gas efficient hollow cathode discharge into a magnetron type anode cathode geometry, a reduction of the source operating pressure by at least three ordes of magnitude is anticipated. DOE

N81-28875# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.

REACTIONS OF CHARGED AND NEUTRAL RECOIL PARTICLES FOLLOWING NUCLEAR TRANSFORMATIONS Final Report

Hans J. Ache Dec. 1980 20 p refs
(Contract DE-AS05-76ER-03602)
(ORO-3602-21) Avail: NTIS HC A02/MF A01

A summary is given of the various activities conducted as part of the research on the chemical reactions of energetic particles generated in nuclear reactions. Emphasis was on hot atom chemistry in gases and liquids. A bibliography of 110 publications published as part of the program is included. DOE

N81-28876# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.

STOCHASTIC COOLING OF 200 MeV PROTONS

Glen Lambertson, J. Bisognano, W. Flood, L. J. Laslett, C. Leemann, B. Leskovar, C. C. Lo, R. Main, L. Smith, and J. Staples Jul. 1980 6 p refs Presented at the 11th Inter. Conf. on High Energy Accelerators, Geneva, 7-11 Jul. 1980
(Contract W-7405-eng-48)
(LBL-10757; CONF-800740-27) Avail: NTIS HC A02/MF A01

Vertical and longitudinal cooling was achieved at the FNAL 200 MeV cooling ring. Initial longitudinal cooling times of 20 seconds for 1.5 x 1 million circulating protons are in approximate 20 seconds for 1.5 x 1 million circulating protons are in approximate agreement with calculations based on measured system parameters. The cooling systems have an electronic bandwidth of approximately 300 MHz, traveling wave pickups and kickers, and a notch filter using flexible cable. The traveling wave structures provide a good signal-to-noise ratio and reduce output power requirements. DOE

N81-28877# Fermi National Accelerator Lab., Batavia, Ill.

INTRODUCTION TO GAUGE THEORIES OF THE STRONG, WEAK, AND ELECTROMAGNETIC INTERACTIONS

C. Quigg Jul. 1980 137 p refs Lectures presented at the NATO Advanced Study Inst., Tech. and Concepts of High Energy Phys., St. Croix, U.S. Virgin Islands, 2-13 Jul. 1980
(Contract DE-AC02-76CH-03000)
(FERMILAB-CONF-80/64THY) Avail: NTIS HC A07/MF A01

The idea of gauge invariance is introduced and the connection between conservation laws and symmetries of the Lagrangian is recalled. Non-Abelian gauge field theories are constructed by analogy with the familiar case of electromagnetism. The Yang-Mills theory based upon isospin symmetry is constructed explicity and the generalization is made to other gauge groups. Spontaneous symmetry breaking and the phenomena that occur in the presence or absence of local gauge symmetries are discussed. The existence of massless scalar fields (Goldstone particles) and their metamorphosis by means of the Higgs mechanism are illustrated by simple examples. The Weinberg-Salam model is presented and a brief resume of application to experiment is given. Quantum chromodynamics, the gauge theory of colored quarks; and gluons, is developed. Asymptotic freedom is derived schematically and a few simple applications of perturbative QCD are exhibited. The strategy of grand unified theories of the strong, weak, and electromagnetic interactions is outlined. Some properties and consequences of the minimal unifying group SU(5) are presented and the gauge hierarchy problem is introduced. DOE

N81-28878# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.

GENERATION AND FOCUSING OF PULSED INTENSE ION BEAMS Final Progress Report, 1 Apr. - 30 Sep. 1979

R. N. Sudan and D. A. Hammer Apr. 1981 31 p refs
(Contract DE-AC02-77DP-40012)
(DOE/DP-40012/T1) Avail: NTIS HC A03/MF A01

Theoretical calculations suggest that an intense pulsed approximation 1 MeV proton beam can be used to simulate the

characteristics of approximately 1 GeV heavy ion beam propagation in an inertial confinement fusion reactor chamber. Given the present availability of the format beams and the high projected cost for obtaining the latter ones, such experimental simulations appear appropriate. Work was undertaken to apply the technology of intense proton beams to this end. The first task was the development of a high brightness pulsed proton source which could produce a weakly convergent approximately 10 kA proton beam in a field free drift region. This was accomplished at approximately 250 keV, and preliminary beam propagation experiments were performed. It was concluded that a proper simulation experiment would require a higher voltage beam. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-28879 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN EXPERIMENTAL AND THEORETICAL STUDY OF CHARMED AND STRANGE HADRON PRODUCTION IN ANTINEUTRINO AND NEUTRINO CHARGED CURRENT INTERACTIONS AT HIGH ENERGIES Ph.D. Thesis
Raymond L. Brock, Jr. 1980 343 p
Avail: Univ. Microfilms Order No. 8108300

The production of charmed particles and strange neutral hadrons by neutrinos and antineutrinos is analyzed from two points of view. A phenomenological basis for the proposition that a suppression is likely for the production of charmed quarks is discussed. An anaysis of mu(-)e(-) data collected from neutrino-Neon scattering is present and it is shown that these data provide the evidence supporting this contention. A method for enhancing charmed particle production and two methods of determining the strange quark sea in the nucleon are discussed. An experiment is described which studied the reaction anti-nu p yields mu(+)X(0). Results from the theoretical sections are used to analyze these data to show that K(0) sub S production occurs within a fragmentation model at a rate which is in agreement with an electroproduction experiment and that a significant portion of events with strange particles come from charmed hadron production. Dissert. Abstr.

N81-28880# Mission Research Corp., Albuquerque, N. Mex.
COLD-FLUID MODEL OF RESISTIVE INSTABILITIES ON INTENSE RELATIVISTIC ELECTRON BEAMS Technical Report, Nov. 1980 - Apr. 1981
T. P. Hughes and B. B. Godfrey 21 May 1981 29 p refs
(Contract N60921-80-C-0124)
(AD-A100509; AMRC-R-285) Avail: NTIS HC A03/MF A01 CSCL 20/8

Resistive instabilities with azimuthal mode numbers m = 0 and 1 are studied on intense, relativistic electron beams. An exact cold-fluid model of the beam is used, and the background is modeled by a scalar conductivity. The effects of the beam profile, the width of the conductivity and return current profiles, and the magnitude of the return current fraction are considered for beams in the 10-100 kA range with gamma = 100. Some results for modes with m = 2 and 3 are also presented. Author (GRA)

N81-28881# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
WAVE-PARTICLE INTERACTION ON RELATIVISTIC ELECTRON BEAMS Summary Report, 1 Jun. 1980 - 1 Jun. 1981
Ira B. Bernstein and Jay L. Hirshfield 15 Jun. 1981 44 p refs
(Contract N00014-79-C-0588; NR Proj. 020-043)
(AD-A100471; Summ-3/4) Avail: NTIS HC A03/MF A01 CSCL 20/5

Contents: Free-Electron Laser with a Strong Axial Magnetic Field; Electron Beam Dynamics in Combined Guide and Pump Magnetic Fields for Free Electron Laser Applications; Theory of the Free Electron Laser in Combined Helical Pump and Axial Guide Fields; Orbit Stability in Free Electron Lasers; Degradation in Gain for a Free Electron Laser Amplifier Due To Electron Momentum Spread. GRA

N81-28882# Battelle Pacific Northwest Labs., Richland, Wash.
NUCLEAR-WASTE ENCAPSULATION BY METAL-MATRIX CASTING
R. G. Nelson, J. F. Nesbitt, and S. C. Slate May 1981 60 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3750) Avail: NTIS HC A04/MF A01

Several encapsulation casting processes, developed to embed simulated high-level wastes of two different forms (glass marbles and ceramic pellets) in metal matrices, are described. Preliminary evaluations of these casting processes and the products are presented. Demonstrations show that 5- to 10-mm-dia glass marbles can be encapsulated on an engineering scale with lead or lead alloys by gravity or vacuum processes. Marbles approx. 12 mm in dia were successfully encapsulated in a lead alloy on a production scale. Also, 4- to 9-mm-dia ceramic pellets in containers of various sizes were completely penetrated and the individual pellets encased with aluminum-12 wt percent silicon alloy by vacuum 12 wt percent silicon alloy vacuum-cast around ceramic pellets had the highest degree of infiltration or coverage of pellet surfaces. DOE

N81-28883# Battelle Pacific Northwest Labs., Richland, Wash.
NATURALLY OCCURRING CRYSTALLINE PHASES: ANALOGUES FOR RADIOACTIVE WASTE FORMS
R. F. Haaker Jan. 1981 284 p refs
(Contract DE-AC06-76RI-01830)
(PNL-3505) Avail: NTIS HC A13/MF A01

Naturally occurring mineral analogues to crystalline phases that are constituents or crystalline radioactive waste forms provide a basis for comparison by which the long term stability of these phases may be estimated. The crystal structures and the crystal chemistry of the following natural analogues are presented: baddeleyite; hematite; nepheline; pollucite; scheelite; sodalite; spinel apatite, monazite, uraninite; hollandite-priderite, perovskite; and zirconolite. For each phase in geochemistry, occurrence, alteration and radiation effects are described. A selected bibliography for each phase is included. DOE

N81-28884# Los Alamos Scientific Lab., N. Mex.
INTENSE LOW-EMITTANCE-ELECTRON-GUN DEVELOPMENT AT PHERMEX
J. C. Elliott, R. J. Faehl, H. J. Fullbright, D. C. Moir, and C. E. Swanmack 1981 15 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-783; CONF-810314-107) Avail: NTIS HC A02/MF A01

Experimental measurements and theoretical calculations were performed and compared for the PHERMEX standard electron gun. Slight changes in the gun configuration produced significant changes in beam intensity and quality. It is anticipated the present gun configuration can be extended in even higher perveances (without significant loss of beam quality). DOE

N81-28885# South Carolina Univ., Columbia. Dept. of Physics and Astronomy.
HIGH-RESOLUTION POSITRON Q-VALUE MEASUREMENTS AND NUCLEAR-STRUCTURE STUDIES FAR FROM THE STABILITY LINE Final Progress Report, 1 Mar. 1980 - 28 Feb. 1981
F. T. Avignone, III 28 Feb. 1981 63 p refs Submitted for publication
(Contract DE-AS09-79ER-10434)
(DOE/ER-10434/2) Avail: NTIS HC A04/MF A01

Extensive data analysis and theoretical analysis was done to complete the extensive decay scheme investigation of Fr-206,208 and the level structures of Rn-206,208. Extensive Monte Carlo calculations were made to correct the end point energies of positron spectra taken with intrinsic Ge detectors for annihilation radiation interferences. These calculations were tested using the desay of Sr-82 which has previously measured

positron branches. The technique was applied to the positron spectra collected at the online UNISOR isotope separator. DOE

N81-28886# California Univ., Berkeley. Engineering and Technical Services Div.

PRACTICAL NEUTRON DOSIMETRY AT HIGH ENERGIES

J. B. McCaslin and R. H. Thomas Oct. 1980 40 p refs Presented at the European Seminar on Radiation Protection Quantities for External Exposure, Braunschweig, West Germany, 13-15 Oct. 1980

(Contract W-7405-eng-48)

(LBL-11652; CONF-8010168-1) Avail: NTIS HC A03/MF A01

Dosimetry at high energy particle accelerators is discussed with emphasis on physical measurements which define the radiation environment and provide an immutable basis for the derivation of any quantities subsequently required for risk evaluation. Results of interlaboratory dosimetric comparisons are reviewed and it is concluded that a well supported systematic program is needed which would make possible detailed evaluations and intercomparisons of instruments and techniques in well characterized high energy radiation fields. High energy dosimetry is so coupled with radiation transport that it is clear their study should proceed concurrently. DOE

N81-28887# Hanford Engineering Development Lab., Richland, Wash.

CONTINUOUS GAMMA-RAY SPECTROMETRY IN THE FAST FLUX TEST FACILITY (FFTF)

Raymond Gold, Bruce J. Kaiser, Frank S. Moore, Jr., Wilbur L. Bunch, William N. McElroy, and Edwin M. Sheen 1980 20 p refs Presented at the Am. Nucl. Soc. Topical Meeting on Advan. in Reactor Phys. and Shielding, Sun Valley, Idaho, 14-17 Sep. 1980

(Contract DE-AC14-76FF-02170)

(HEDL-SA-2116; CONF-800942-21) Avail: NTIS HC A02/MF A01

Gamma ray continua were measured at startup in the Fast Flux Test Facility (FFTF). A special FFTF insert, called the In-Reactor Thimble (IRT), provided an adequate environment for in situ operation of the gamma spectrometer. The IRT replaced a fuel assembly near core center (No. 2101) and measurements were conducted at three axial locations, namely midplane, the lower axial shield, and the upper axial reflector. Observations were carried out with Compton Recoil Gamma Ray Spectrometry at the state of the art. Advantage was thereby taken of the most recent advances, including extension of gamma ray spectrometry up to roughly 7 MeV with the new in situ Janus detector probe. DOE

N81-28888# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.

SPENT FUEL DRY STORAGE TECHNOLOGY DEVELOPMENT: REPORT OF CONSOLIDATED THERMAL DATA

W. L. Lundberg Sep. 1980 52 p refs

(Contract DE-AC08-76NV-00597)

(DOE/NV-00597/6) Avail: NTIS HC A04/MF A01

A drywell/sealed cask technique for spent fuel storage is discussed. Experiments indicate that PWR fuel with decay heat levels in excess of 2 kW could be stored in isolated drywells in Nevada test site soil without exceeding the current fuel clad temperature limit (715 F). The ability to thermally analyze near surface drywells and above ground storage casks is assessed. It is concluded that the required analysis procedures, computer programs, etc., are already developed and available. Soil thermal conductivity requires additional study to better understand the soil drying mechanism and effects of moisture. Work is also required to develop an internal canister subchannel model. In addition, the ability of the overall drywell thermal model to accommodate thermal interaction effects between adjacent drywells should be confirmed. DOE

N81-28889# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.

SPENT FUEL DRY STORAGE TECHNOLOGY DEVELOPMENT: THERMAL EVALUATION OF ISOLATED DRYWELLS CONTAINING SPENT FUEL (1 kW PWR SPENT FUEL ASSEMBLY)

R. Unterzuber and J. B. Wright Sep. 1980 215 p refs

(Contract DE-AC08-76NV-00597)

(DOE/NV-00597/5) Avail: NTIS HC A10/MF A01

A spent fuel Isolated Drywell Test was conducted at the Engine-Maintenance, Assembly and Disassembly (E-MAD) facility on the Nevada Test Site. Two PWR spent fuel assemblies having a decay heat level of approximately 1.1 kW were encapsulated inside the F-MAD Hot Bay and placed in instrumented near-surface drywell storage cells. Temperatures from the two isolated drywells and the adjacent soil were recorded throughout the 19 month Isolated Drywell Test. Canister and drywell linear tempefatures reached their peak values (2540 F and 2030 F, respectively) during August 1979. Thereafter, all temperatures decreased and showed a cycling pattern which responded to seasonal atmospheric temperature changes. A computer model as utilized to predict the thermal response of the drywell. Computer predictions of the drywell temperatures and the temperatures of the surrounding soil are presented and show good agreement with the test data. DOE

N81-28890# Stanford Linear Accelerator Center, Calif.

EXPERIMENTAL OBSERVATIONS AND THEORETICAL MODELS FOR BEAM-BEAM PHENOMENA

S. Kheifets Mar. 1981 89 p refs Presented at the Workshop on Long-Time Prediction in Nonlinear Conservative Dynamical Systems, Austin, Tex., 16-19 Mar. 1981

(Contract DE-AC03-76SF-00515)

(SLAC-PUB-2700) Avail: NTIS HC A05/MF A01

The beam-beam interaction in storage rings exhibits all the characteristics of nonintegrable dynamical systems. The storage ring itself presents an opportunity of experimentally studying the long-time behavior of both conservative (proton machines) and nonconservative (electron machines) dynamical systems - the number of bunch-bunch interactions routinely reaches values of 10 to the 10th power to 10 to the 11th power and could be increased by decreasing the beam current. At the same time the beam-beam interaction puts practical limits for the yield of the storage ring. This phenomenon not only determines the design value of main storage ring parameters (luminosity, space charge parameters, beam current), but also in fact prevents many of the existing storage rings from achieving design parameters. DOE

N81-28891# Hughes Aircraft Co., Culver City, Calif.

PULSED WIP ELECTRON GUN. FABRICATION PHASE 1 X 40 cm AND 1 X 70 cm COOLED WIP ELECTRON GUN Final Report, Mar. 1979 - Dec. 1980

G. Wakalopulos 1980 29 p

(Contract W-7405-eng-48)

(UCRL-15327) Avail: NTIS HC A03/MF A01

An electron gun capable of long-run operation at 10 KHz and 1 A sq cm was fabricated and tested. Pulse widths of 200 to 600 nsec and a total life of greater than 10 to the 7th power shots were demonstrated. During the acceptance tests, the electron gun was operated at a total average power of 20 KW for 30 minutes. To establish some upper limit of the gun's capability, the device was operated at a repetition rate of 3.5 KHz at a total average power of 54.5 KW for greater than 10 minutes. During these tests, no high voltage breakdown occurred after the device was processed. The beam uniformity at high repetition rates is + or - 10% and the efficiency is 50%. DOE

N81-28892# Stanford Linear Accelerator Center, Calif.

NON-LINEAR OPTICS FOR THE FINAL FOCUS OF THE SINGLE-PASS-COLLIDER

K. L. Brown and J. E. Spencer Feb. 1981 3 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981

(Contract DE-AC03-76SF-00515)

(SLAC-PUB-2678; PEP-Note-345; CONF-810314-152) Avail: NTIS HC A02/MF A01

The problems encountered in the design of a final focus system that will reliably provide the desired beam size for collisions are reported. The purpose of the final focus system (FFS) is to demagnify the beam envelope in the Collider arc lattice to a size suitable for beam collisions at the interaction region. The final spot size is determined by the beam emittance, the beta

function (ALPHA)* at the IR, the momentum spread in the beam, and the quality of the FFS optics. The momentum dispersion in the beam can lead to a substantial degradation in the quality of he final focus. The objective is to design a FFS for 50 GeV/c within approx. 100 meters with an IR spot size sigma (sub xy) of approximately 2 (SIGMA)m for a beam emittance of epsilon = 3 x 10(+1) 0 m-rad and a momentum spread of delta = + or - 0.5%. This requires a (ALPHA) (sub x,y) equal to or less than 1 cm. DOE

N81-28893# Kollmorgen Corp., Radford, Va. Inland Research and Development Center.
ION WAVE INSTABILITIES IN LASER-GENERATED PLASMAS Final Report
E. J. Yadlowsky, Robert C. Hazelton, and Russell J. Churchill Dec. 1980 48 p refs
(Grant NSF ENG-77-28250)
(PB81-168270; TR-80J01; NSF/RA-800432) Avail: NTIS HC A03/MF A01 CSCL 18A

Procedures of achieving nuclear fusion in laser target plasma experiments are described. Thomson scattering is used to directly measure ion density fluctuations without the complication of self generated magnetic fields and resonant absorption processes. The plasma is generated in hydrogen or deuterium at a pressure of 300 torr by a pulsed CO2 laser and the resulting plasma is diagnosed using a ruby laser to obtain the density, expansion velocities, shock structure and fluctuation level from holographic interferograms, Schlieren photographs and incoherent scattering measurements respectively. GRA

74 OPTICS

Includes light phenomena.

N81-28894 British Library Lending Div., Boston Spa (England).
USE OF InP IN INTEGRATED OPTICS CIRCUITS
Jaroslav Kovac, Rudolf Srnanek, and Jan Jakabovic Aug. 1980 12 p refs Transl. into ENGLISH from Elektrotech. Cas. (Bratislava), v. 30, no. 9, 1979 p 718-723
(BLL-RDL-Trans-3837-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The possibility of using InP in the electro-optics field is discussed. It is shown that InP in conjunction with the quaternary alloy InGaAsP can create effective radiation sources and detectors in the range 1060 to 1680 nm for the transmission of information by optical fibers. Techniques for the growth of epitaxial layers from the droplet phase are described. M.G.

N81-28895 California Univ., Los Angeles.
SCATTERING OF LIGHT FROM DEFECTS IN OPTICAL MATERIALS Ph.D. Thesis
James Erroll Rogers 1980 245 p
Avail: Univ. Microfilms Order No. 8113878

Light scattering from a smooth optical surface that contains a few isolated macroscopic defects is investigated. The size and shape of a group of these defects were measured as an aid in formulating a model of the scattering of light from isolated macroscopic defects. An important aspect of this model is the determination of the change in the state of polarization of the scattered light. The model was used to develop a computer program based on a Monte Carlo algorithm for calculating the scattering and polarization changes in light incident on various defects. To verify the computer modeling, the scattering caused by several different types of defects was measured. The results were then used to obtain a better understanding of the role of isolated macroscopic defects in the performance of a glass honeycomb solar heat collector. Dissert. Abstr.

N81-28896 Rochester Univ., N. Y.
PHASE RETRIEVAL TECHNIQUES FOR IMAGE AND WAVEFRONT RECONSTRUCTION Ph.D. Thesis
Richard Henry Boucher 1980 214 p
Avail: Univ. Microfilms Order No. 8114127

The recovery of the phase of a complex amplitude image from measurements of its modulus is examined. Practical aspects of image phase and wavefront reconstruction from measured intensity distributions in two defocused planes of an optical system are considered. Measurement of the image and diffraction planes or two defocused image planes has been shown to give a unique solution to the phase if the image is analytic and has a spectrum which is analytic and regular. The reconstruction is also unique for sampled representations images if certain precautions are taken. Three methods of phase retrieval using image intensities measured in two defocused planes are examined: a direct method, the Misell or Gerchberg-Saxton algorithm, and a gradient search method. These are studied for effectiveness in image phase reconstruction under various conditions, including the presence of errors and noise. Relationships between the phase problem in image diffraction or two defocused image planes and the use of the ambiguity function in optics are examined. Dissert. Abstr.

N81-28897# New England Research Center, Sudbury, Mass.
THE 2.06 MICROMETER WIDE BANDWIDTH DETECTOR ASSEMBLY Final Report
Angelo Trainito Fort Belvoir, Va. Night Vision and Electro Optics Lab. Feb. 1981 40 p
(Contract DAAK70-80-C-0009)
(AD-A100132; AD-E450005) Avail: NTIS HC A03/MF A01 CSCL 17/8

This program demonstrated that high performance, wide bandwidth mercury cadmium telluride photoconductor detectors can be fabricated with a spectral peak at 2.06 micrometers. Detectivity at a frequency of 10 megahertz are on the order of 2 x 10 to the 11th power to 7 x 10 to the 11th power cmHz (1/2)/w-1) at an operating temperature of 235 degrees Kelvin. This performance was achieved using standard procedures for processing 10 micron thick mercury cadmium telluride detectors. GRA

N81-28898# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
EXPERIMENTALLY DETERMINED RELATIONSHIP BETWEEN EXTINCTION AND LIQUID WATER CONTENT
Dorothy Bruce, Charles W. Bruce, Young Paul Yee, Lynn Cahenzli, and Hans Burket Apr. 1981 30 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A100449; ERADCOM/ASL-TR-0083) Avail: NTIS CSCL 04/1

Simultaneous environmental chamber measurements have been made of 10.27 micrometers extinction coefficients and liquid water content of droplet distributions with sizes spanning those of light to heavy fogs. The measurements yield a linear relation which is nearly independent of droplet size distribution, in agreement with recent calculated results and predictions. Liquid water content varied from 0.01 to 3.3 gm/cu m and droplet size distributions with single mode and bimodal differential extinction coefficient curves (extinction coefficient as a function of droplet size) were included. The spectral variation of extinction coefficient between 9.2 micrometers and 10.8 micrometers was also measured. The results are in good agreement with the variation calculated for typical droplet size distributions.
Author (GRA)

N81-28899# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESOLUTION OF CLOSELY SPACED OPTICAL TARGETS USING MAXIMUM LIKELIHOOD ESTIMATOR AND MAXIMUM ENTROPY METHOD: A COMPARISON STUDY
Ming-Jer Tsai 3 Mar. 1981 29 p refs
(Contract F19628-80-C-0002)
(AD-A100477; TR-ESD-TR-557; ESD-TR-81-79) Avail: NTIS HC A03/MF A01 CSCL 17/8

The capabilities of the maximum likelihood estimator (MLE) and the maximum entropy method (MEM) in resolving closely spaced optical point targets are compared using Monte Carlo simulation results for three different examples. It is found that the MEM is very sensitive to the noise and that the MLE performs better than the MEM in all examples. Author (GRA)

N81-28900# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Dept. of Radioactive Engineering.
FIBER-OPTIC REMOTE PHOTOMETRY
G. Boisde and J. J. Perez [1981] 22 p refs Presented at Colloq. Photon 80, Paris, 21-23 Oct. 1980

(Contract DE-AC09-76SR-00001)
(DP-TR-18) Avail: NTIS HC A02/MF A01

The leading principles and properties of optical fibers are described. Some general data on various fibers on the market are given. DOE

N81-28901# National Bureau of Standards, Washington, D.C.
REPORT ON RESEARCH ON OPTICAL COATINGS Final Report
W. Haller, D. M. Sanders, and E. N. Farabaugh 13 Jan. 1981 17 p
(Contract DE-AI08-79DP-40094)
(DOE/DP-40094/T1) Avail: NTIS HC A02/MF A01

The construction of an apparatus designed to prepare thin films by physical vapor codeposition is described. This apparatus permits the characterization of the substrate prior to deposition using electron spectroscopy for chemical analysis, auger electron spectroscopy, secondary ion mass spectroscopy, and ion scattering spectroscopy. The system permits deposition of thin films by resistively heated boats and electron beam evaporation sources which can be operated simultaneously. The resulting films can be characterized using the above surface analysis techniques without exposure to the atmosphere using a transfer mechanism described in the report. DOE

N81-28902# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
ELASTIC AND INELASTIC LIGHT SCATTERING AT WAVELENGTHS ON AND OFF STRUCTURE RESONANCES OF SPHERES AND CYLINDERS
J. F. Owen, P. W. Barber, R. E. Benner, and R. K. Chang 1980 7 p refs
(Grants NSF ENG-77-07157; DAAG29-79-G-0008)
(PB81-178253; NSF/RA-800411) Avail: NTIS HC A02/MF A01 CSCL 20F

Special and angular distributions are examined both experimentally and theoretically. Structure resonances in the elastic scattering occur when the incident wavelength corresponds to a discrete natural mode of oscillation of the sphere. Based on previous studies indicating that structure resonances are expected to occur for inelastic emission from fluorescent dipoles within the sphere, such structure resonances were observed at specific fluorescent wavelengths from a single dye-impregnated polystyrene sphere suspended in a fluid. Conditions for resonance are the same for both elastic and inelastic scattering, and excellent agreement is obtained between the experimental results and a calculation based on the Lorenz/Mie theory. Fluorescent uranium doped glass fibers were used for angular distribution measurement as well as for wavelength measurements. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-28903 Colorado Univ. at Boulder.
NONLINEAR LANGMUIR WAVES IN A WEAK MAGNETIC FIELD Ph.D. Thesis
James Christopher Weatherall 1980 176 p
Avail: Univ. Microfilms Order No. 8114021

Large amplitude Langmuir waves are known to experience a variety of nonlinear effects; they can couple to other modes in the plasma to excite parametric instabilities; they can also self-focus to form localized regions of intense electrostatic fields. The effect of a weak magnetic field on both of these processes was studied. A set of coupled equations between the envelope electric field and the plasma density were derived with careful treatment of the magnetic field. When the electron cyclotron frequency is less than the plasma frequency, the dominant nonlinearities do not involve the magnetic field. However, the magnetic field does increase the dispersion of the Langmuir-waves and prevents density prturbations directly transverse to the field. Numerical calculations show that when the magnetic dispersion exceeds the thermal dispersion of Langmuir waves generated by parametric instability, the wave vectors of these waves shift to smaller perpendicular wavenumbers. Dissert. Abstr.

N81-28904 Institute of Plasma Physics, Prague (Czechoslovakia).
ON RADIATION FORCES IN DISSIPATIVE PLASMA
V. A. Petrzilka Dec. 1980 7 p refs
(IPPCZ-238) Copyright. Avail: Issuing Activity

The dissipation of the mechanical and the electromagnetic momentum densities in contrast to the dissipation of the electromagnetic momentum density only is discussed in a simple model. Author

N81-28905 Institute of Plasma Physics, Prague (Czechoslovakia).
THE DYNAMICS OF LANGMUIR SOLITONS IN THE PRESENCE OF ION-SOUND DAMPING
P. Krocek Apr. 1980 18 p refs
(IPPCZ-233) Copyright. Avail: Issuing Activity

The Langmuir soliton in the presence of driven ion-sound which is damped due to plasma electrons is considered. Starting from the modified Zakharov equations, the nonlinear Schrodinger equation with a small operator term is obtained which describes nonstationary Langmuir soliton evolution. The Karpman-Maslov perturbation approach based on an inverse scattering method is used to find the variation of soliton parameters and form. M.G.

N81-28906 Institute of Plasma Physics, Prague (Czechoslovakia).
INTERACTION OF A RELATIVISTIC ELECTRON BEAM WITH A PLASMA CLUSTER
P. Sunka, K. Jungwirth, I. Kovac, V. Piffl, J. Stoeckel, and J. Ullschmied Mar. 1980 22 p refs
(IPPCZ-233) Avail: Issuing Activity

Use of the REBEX machine permitted comparison of the efficiency of plasma heating in propagating and oscillating beam regimes. The propagating beam energy loss decreases with increasing the plasma density. The best transport was achieved at the highest plasma density (10 to the 20th power/cu m). Plasma heating is completely due to the two stream instability in this regime. In the oscillating beam regime, the plasma energy content is 2 to 3 times higher, although the plasma column is shorter and its density (10 to the 21 power/cu m) is more inhomogeneous. The corresponding plasma energy density exceeds then, by an order of magnitude, that of a plasma heated optimally by a propagating REB. Simultaneously, ions are collectively accelerated from the plasma boundary. This process is most efficient in systems with an effectively one dimensional virtual cathode. A.R.H.

N81-28907 Institute of Plasma Physics, Prague (Czechoslovakia).
THE EFFECT OF HF FIELD ON DIFFUSION AND CONVECTION IN A PLASMA COLUMN
R. Klima and V. A. Petrzilka Nov. 1979 15 p refs
(IPPCZ-232) Copyright. Avail: Issuing Activity

A cylindrical plasma model with both axial and azimuthal steady magnetic field is used. Nonlinear excitation of time averaged electric currents by the HF field is analyzed. Ponderomotive forces of the HF field also lead to translational and rotational plasma motions. Radial plasma diffusion can be modified by the presence of the HF field at sufficiently low frequencies. The analysis can be applied to problems of anomalous transport. Author

N81-28908 Institute of Plasma Physics, Prague (Czechoslovakia).
ON THE ACCELERATION OF PARTICLES TRAPPED IN THE EFFECTIVE POTENTIAL TROUGH OF THE BEAT OF TWO WAVES
L. Krlin Dec. 1979 7 p refs
(IPPCZ-231) Copyright. Avail: Issuing Activity

It is noted that, under special conditions, the beat of two waves can change its velocity of propagation. The possibility of the acceleration of particles trapped in the beat potential trough is discussed. Change of the beat velocity is achieved by means of the inhomogeneity of the magnetostatic field. Two waves, forming the beat, can be excited, e.g., by means of the beam-plasma interaction. M.G.

N81-28909 Institute of Plasma Physics, Prague (Czechoslovakia).
EFFECT OF TRAPPED PARTICLES IN THE BEAT OF TWO WAVES ON THE WAVE DYNAMICS

L. Krlin Dec. 1979 22 p refs
(IPPCZ-230) Copyright. Avail: Issuing Activity

The effect of trapped particles in the beat of two electrostatic waves on the wave dynamics is investigated. A simple analytical model is used. Changes in amplitudes and frequencies of waves and in the distribution function of particles are established. Consequences for the anomalous absorption are discussed. The possibility of the pumping of the wave energy into particles and of the phase bunching of particles appears. An application of the best-trapping effects in the relativistic beam-plasma interaction is discussed. Author

N81-28910 Institute of Plasma Physics, Prague (Czechoslovakia).
FLUID DESCRIPTION OF PARTICLE TRANSPORT IN HF HEATED MAGNETIZED PLASMA
R. Klima Sep. 1979 21 p refs
(IPPCZ-229) Copyright. Avail: Issuing Activity

Particle fluxes averaged over the high frequency oscillations are analyzed. Collisional effects and kinetic mechanisms of energy absorption are included. Spatial dependences of both the high frequency and the quasi-steady electromagnetic fields are arbitrary. Equations governing the fluxes are deduced from moments of the averaged kinetic equation. Explicit expressions for steady state fluxes are given in terms of electromagnetic field quantities. The results can also be applied to anomalous transport phenomena in weakly turbulent plasmas. Author

N81-28911 Arizona Univ., Tucson.
INVESTIGATIONS OF THE USE OF INDUCTIVELY COUPLED PLASMA EMISSIONS FOR CHEMICAL ANALYSIS Ph.D. Thesis
David Russell Heine 1981 149 p
Avail: Univ. Microfilms Order No. 8115067

Investigations of applications of the inductively coupled plasma (ICP) for analytical atomic emission spectroscopy are performed. Emissions below 185 nm, analysis of wear metals in lubricating oils, and use of the ICP as a selective detector for high performance liquid chromatography (HPLC) are studied. A unique plasma coolant tube containing a side arm which allows direct observation of the discharge is used to investigate emissions in the vacuum ultraviolet spectral region between 120 and 185 nm. Emission from elements which do not emit radiation in the visible region are observed. A heated sample introduction system attached to a Babington nebulizer is investigated as a means to aerosolize lubricating oils for introduction into the ICP. This allows direct analysis of wear metals in oil samples without requiring the usual sample dilutions. The ICP is used as a selective detector for HPLC. Nucleotides separated by anion exchange chromatography are determined in the ICP by observing phosphorous emissions. Methanol and acetonitrile used for reverse phase HPLC are successfully run in the IPC. Dissert. Abstr.

N81-28912 California Univ., Los Angeles.
CHAOTIC SOLUTIONS OF NONLINEAR WAVE-WAVE INTERACTING SYSTEMS IN PLASMAS Ph.D. Thesis
Koshiro Masui 1980 147 p
Avail: Univ. Microfilms Order No. 8113871

The chaotic behavior and phase locking in wave-wave interacting systems with linear damping or growth terms are studied. For a two or three wave interaction, the system equations are reducible to a real three dimensional equation on a certain set sigma in the state space. For a three wave interaction, the phases of the waves are locked on sigma. Only systems of positive-energy waves whose reduced equations may have chaotic behavior for almost all initial conditions are considered. Sufficient conditions for asymptotic phase locking as t approaches infinity are obtained in three wave interacting systems, which depend on the sizes of the attractors for the trajectories. The trajectory behavior of the reduced equations is studied numerically in detail. For certain values of the parameters, the first return mappings of the trajectories have properties which are similar to those of one dimensional mappings having parabolic graphs. Simple models are introduced to explain schematically the transition of attractors for the trajectories. Finally, certain statistical properties of the first return mappings are considered in the light of the known theorems for one dimensional mapping. Dissert. Abstr.

N81-28913 Columbia Univ., New York.
SUBCRITICALITY IN NONBOUSSINESQ CONVECTION Ph.D. Thesis
Cristina Teran Depassier 1980 118 p
Avail: Univ. Microfilms Order No. 8113502

Finite amplitude convection when the heat flux on the boundaries is held fixed is studied in three cases. A plane parallel layer of perfect gas with constant material properties is considered. It is found that the critical wavenumbers is zero in a wide range of parameters and that in this case there is finite amplitude instability. In the thin layer limit there is finite amplitude instability for very long horizontal wavelengths. Next, the effect of including the temperature dependence of the properties of the fluid but neglecting compressibility is studied. As in the thin layer limit of the compressible gas, there is finite amplitude instability for sufficiently long wavelengths. Under certain assumptions subcritical stable branch of solutions is found. For shorter wavelengths the finite amplitude solutions bifurcate supercritically. Finally the effect of a free surface on Boussinesq convection is investigated. It is that the free surface has a destabilizing effect and that convection may appear as an overstability. Also, small amplitude solutions are unstable. Dissert. Abstr.

N81-28914 Rochester Univ., N. Y.
EFFECT OF PREPULSE RADIATION ON NON-THERMAL RADIATION (< K ev/Z) IONS IN LASER PRODUCED PLASMA Ph.D. Thesis
Sanwal Prasad Sarraf 1980 164 p
Avail: Univ. Microfilms Order No. 8113618

A group of non-thermal ions generated from laser plasma by a glass laser irradiated on glass microballoons is investigated using a Thomson parabola ion spectrometer. The effect at prepulse radiation, various prepulse-main pulse timings and amplitudes, are examined. From the measured ion density distribution, isothermal expansion of the plasma seems to be a reasonable assumption. Hot electron temperature is deduced from this. Ion front (sheath) velocity is determined. Larger amplitude, high frequency modulations in ion density distribution were observed, and explained by a model based on two stream ion-ion instability. Non thermal ions of energy up to 50 KTsub were detected. The results are compared with existing theoretical models.
Dissert. Abstr.

N81-28915 Pennsylvania State Univ., University Park.
COMPUTER SIMULATION OF PLASMA BEHAVIOR IN OPEN-ENDED LINER THETA PINCHES Ph.D. Thesis
Elmer Kenneth Stover 1981 302 p
Avail: Univ. Microfilms Order No. 8112842

Zero dimensional (0-D) and one dimensional (1-D) fluid plasma computer models were developed to study behavior of linear theta pinch plasmas. Computer simulation results are compared with data from the theta pinch experiments. The 0-D model was developed to evaluate the influence of end loss processes on: (1) midplane plasma temperatures; (2) axially averaged number density; and (3) total particle inventory inside the compression coil. Both particle and energy end loss were treated self consistently in the 1-D model. The relevant spatial coordinate was chosen parallel to the compression coil axis. Exhaust boundary conditions were examined: models approximating the interaction of exhaust plasma with background gas and with vacuum vessel walls were developed. A uniform and a diffuse profile were considered. Plasma temperature was assumed independent of radius in both cases. A simple ion viscosity model was developed to reproduce both measured ion temperatures and measured energy line density rates. Diffuse profile results suggest that reasonable agreement with experiment can be achieved if the electron temperature profile is also chosen diffuse. The analytical electron thermal conduction model examined yielded electron temperatures consistent with 1-D code temperatures.
Dissert. Abstr.

N81-28916 Colorado Univ. at Boulder.
ION DYNAMICS AND COLLISION MEASUREMENTS IN A PENNING TRAP Ph.D. Thesis
Jay Barker Jeffries 1980 255 p
Avail: Univ. Microfilms Order No. 8113973

The dynamic evolution of a sample of molecular ions stored in a Penning trap was observed by bolometrically monitoring

the noise power and frequency of the electrostatic eigenmode of the plasma. These observations display the onset and quenching of collective behavior in a pure ion plasma. An ion cloud was produced by electron impact ionization. The ion-ion Coulomb coupling establishes in less than one second an initial ion energy distribution which is nearly Maxwellian with a temperature of 1000 K. The ion sample thermalizes within a few hundred seconds with the neutral background. During this cooling the Debye length decreases to a minimum, which is nearly the same size as the spatial extent of the ion sample. When this occurs the noise power in the electrostatic eigenmode increases and the noise power signal linewidth decreases indicating the onset of collective motion of the ions. Radial transport of the ions lowers the ion density, hence the Debye length increases and the collective behavior is quenched. Additional results are discussed.
Dissert. Abstr.

N81-28917 Iowa Univ., Iowa City.
BRAGG SCATTERING OF EM WAVES FROM A LABORATORY PLASMA Ph.D. Thesis
Michael John Alport 1980 204 p
Avail: Univ. Microfilms Order No. 8114229

Results from a series of laboratory experiments involving the coherent scattering of x band microwaves from density irregularities and fluctuations in a partially ionized plasma are presented. Most of these results were taken in the situation where the dimensions of the scattering volume were very much larger than the plasma wavelength. The validity of a macroscopic model (parameterized in terms of plasma refractive index) and an equivalent microscopic model (involving the positions and trajectories of the individual charged particles) are verified which described the coherent (Bragg) scattering from stationary periodic plasma perturbations as well as propagating acoustic ion beam mode wave packets. The scattering from plasma turbulence produced by cross field instabilities (density gradient and two stream driven) relating the frequency spectrum of the density fluctuations of the spectrum of the backscattered microwave radiation is also studied. Dissert. Abstr.

N81-28918 Columbia Univ., New York.
CONTROL OF TRAPPED ELECTRON INSTABILITY BY MODULATED NEUTRAL BEAMS Ph.D. Thesis
Morteza Ghassemi 1980 127 p
Avail: Univ. Microfilms Order No. 8113510

Feedback control of the dissipative trapped electron instability in Tokamaks is investigated using a modulated neutral beam as a remote suppressor. Particle input from the beam is found to be the most effective control variable. Oblique injection is found to be the most suitable and the best angle of injection is estimated from the control point of view. The evolution of control source ion distribution function in velocity and configuration space due to pitch angle scattering by collisions with plasma ions is determined by using a Fokker-Planck collision operator. This distribution function is used to find the density profile of the control source in plasma, also coupling of the modulated neutral beam to the instability. Modal decomposition of the instability is used in order to obtain a lumped parameter representation of the multimode instability. Optimal control theory is then applied to stabilize the instability by minimizing a performance index which is chosen to be the sum of residual fluctuation energy (from the instability) and control energy. As sensor signal is corrupted by noise, a Kalman filter is designed to estimate the states which are the complex modal amplitudes of the instability. Dissert. Abstr.

N81-28919 California Univ., Berkeley.
A STUDY OF ION LINE BROADENING IN THE TOKAMAK DISCHARGE Ph.D. Thesis
Robert Stephen Shaw 1980 197 p
Avail: Univ. Microfilms Order No. 8113186

Two versions of Tormac (Toroidal Magnetic Cusp), a magnetic confinement plasma concept having absolute minimum B geometry, are considered. Gaussian HeII 4686 A spectral lines having full widths at half maximum over 2 A were observed in both Tormac plasmas. Indications are that these widths are not simply explained either by thermal Doppler broadening, or Stark broadening due to interparticle fields. Magnetic probe measurements indicate that compressional Alfven modes are excited by the main containment field rise in T IV (c). No indication of this was found in T V. The fluid motion associated with this mode is used to explain the broadcasting of HeII 4686 A during cusp field rise in T IV (c) at which time the broadening is greatest. After field peak, the broadening is explained as Stark broadening due to turbulence excited by a large toroidal plasma current which persists long after cusp peak. This current is larger in T V, and is taken as the sole mechanism for the line broadening.
Dissert. Abstr.

N81-28920# Oak Ridge National Lab., Tenn.
EQUILIBRIUM EVOLUTION ON THE RESISTIVE TIME SCALE IN A TOKAMAK REACTOR
J. A. Holmes, Y.-K. M. Peng, and K. E. Rothe Apr. 1981 29 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7678) Avail: NTIS HC A03/MF A01

In the Engineering Test Facility (ETF) the plasma pulse duration is expected to be hundreds of seconds, which is comparable to the resistive time scale that governs the resistive diffusion of the equilibrium. The resistive evolution of the safety factor q profile may, for MHD stability reasons, limit the duration of the plasma burn in a Tokamak reactor. It may be possible to control this evolution and extend the plasma burn time through proper profile tailoring. We study the evolution of the q profile on the resistive time scale numerically using a one-and-one-half dimensional (1 1/2-D) single fluid transport code. Two high beta (anti (ALPHA)/sub T/ approx. 7 to 16 percent) cases are considered: (1) a beam driven hydrogen plasma with no nuclear alpha heating for which the beam energy is used as a device to control the temperature profile, and (2) an ignited D-T plasma in which the neutral injection has been turned off. GRA

N81-28921# Florida Univ., Gainesville. Dept. of Engineering Sciences.
INVESTIGATION OF NONIDEAL PLASMA PROPERTIES Annual Report, 1 Nov. 1979 - 31 Dec. 1980
Horst E. Wilhelm 1 May 1981 152 p refs
(Contract N00014-79-C-0073)
(AD-A100526) Avail: NTIS HC A08/MF A01 CSCL 20/9

The electrical conductivity of nonideal classical and quantum plasmas is calculated by means of dimensional analysis, kinetic theory, and quantum field theoretical methods. The new conductivity formulas are compared with recent experimental conductivity data for nonideal alkali plasmas. A theory of the electric microfield distribution in thermal plasmas and the anomalous microfield driven diffusion of charged particles across magnetic fields is presented, which is applicable only to ideal and weakly nonideal plasmas. By means of Bose statistics, the free energy of the random, thermally excited (longitudinal) electron and ion waves (collective many-body interactions) are calculated, and their quantitative relation to the free energy of nonideal plasmas is discussed. Author (GRA)

N81-28922# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY DESIGN OF A TANDEM-MIRROR-NEXT-STEP FACILITY
C. C. Damm, J. N. Doggett, R. H. Bulmer, W. S. Neef, G. W. Hamilton, A. E. Sherwood, S. Szybalski, B. M. Boghosian, G. A. Carlson, and R. W. Moir 18 Dec. 1980 120 p refs
(UCRL-53060) Avail: NTIS HC A06/MF A01

The Tandem-Mirror-Next-Step (TMNS) facility is designed to demonstrate the engineering feasibility of a tandem-mirror reactor. The facility is based on a deuterium-tritium (D-T) burning, tandem-mirror device with a fusion power output of 245 MW. The fusion power density in the central cell is 2.1 MW/m(3), with a resultant neutron wall loading of 0.5 MW/m(2). Overall machine length is 116 m, and the effective central-cell length is 50.9 m. The magnet system includes end cells with yin-yang magnets to provide magnetohydrodynamic (MHD) stability and thermal-barrier cells to help achieve a plasma Q of 4.7 (where Q = fusion power/injected power). Neutral beams at energies up to 200 keV are used for plasma heating, fueling, and barrier pumping. Electron cyclotron resonant heating at 50 and 100 GHz is used to control the electron temperature in the barriers. Based on the resulting engineering design, the overall cost of the facility is estimated to be just under $1 billion. Unresolved physics

issues include central-cell beta-limits against MHD ballooning modes (the assumed reference value of beta exceeds the current theory derived limit), and the removal of thermalized alpha-particles from the plasma. GRA

N81-28923# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTATIONAL COMPACT TORUS EXPERIMENT
J. L. Eddleman, B. NcNamara, J. K. Nash, J. W. Shearer, and W. C. Turner 24 Dec. 1980 39 p refs
(Contract W-7405-eng-48)
(UCID-18827) Avail: NTIS HC A03/MF A01

A two-dimensional magnetohydrodynamic calculation of rundown of plasma in a coaxial, magnetized gun and injection of the plasma, and reconnection of the embedded magnetic fields to form a compact toroidal plasma is described. DOE

N81-28924# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETIC FUSION ENERGY
1980 270 p refs Presented at the Am. Phys. Soc. Meeting, San Diego, Calif., Nov. 1980 Sponsored by DOE
(CONF-801119) Avail: NTIS HC A12/MF A01

Reversed field equilibria and transport are examined as well as techniques for plasma diagnostics. Magnetohydrodynamic simulations and the design of a magnetic fusion reactor for commercial use are also described. For individual titles, see N81-28925 through N81-28935.

N81-28925# California Univ., Livermore. Lawrence Livermore Lab. National Magnetic Fusion Energy Computer Center.
BALLOONING MODE GROWTH RATE DEPENDENCE ON SEPARATRIX SHAPE FOR IDEALIZED EQUILIBRIA OF A FIELD REVERSED THETA PINCH
D. V. Anderson, H. L. Berk (Texas Univ., Austin), and J. H. Hammer *In its* Magnetic Fusion Energy 1980 28 p ref (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

The fastest growing ideal MHD modes in a field reversed theta pinch are in the infinite toroidal mode number limit and have low poloidal mode numbers. These are called cointerchange modes or less precisely ballooning modes. Simple analytical models for the equilibria were used to change the shape of the separatrix without changing the pressure function. For the cases examined, it is found that making the separatrix more racetrack in shape reduces growth rates near the vortex point but this is partially offset by an increase of the growth rates near the separatrix. The pressure function associated with the elliptical Hill's vortex model was used. A.R.H.

N81-28926# California Univ., Livermore. Lawrence Livermore Lab.
TRANSPORT AND EQUILIBRIUM IN FIELD REVERSED MIRRORS WITH TOROIDAL FIELD
Steve P. Auerbach *In its* Magnetic Fusion Energy 1980 13 p (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

For a certain class of analytic equilibria, field reversal requires that a certain dimensionless parameter of the equilibriurn, K, must be small: $0 < K$ or $1/3$, expanding in powers of K, simple but accurate representations of these equilibria are developed. As an example, 0 point and separatrix radius are determined in terms of parametes under an experimentalists control: poloidal flux, axial current and vacuum field. As another example, classical transport is studied for a family of spherical equilibria ranging from the high beta Hill's vortex ($k = 0$) to the zero beta spheromax ($k = 1/3$). The classical L/R time for these equilibria is Tau = (4 pi sigma sq R sub 0/sq C)(10-15 k)/1 where R sub 0 is the 0 point radius and sigma is the conductivity. The maximal toroidal field ($k = 1/3$, zero beta) produces decay times only twice as large as the high beta, zero toroidal field case ($k = 0$). A.R.H.

N81-28927# Texas Univ., Austin. Inst. for Fusions Studies.
LINEAR AND NONLINEAR COMPUTATIONS OF THE IDEAL MHD TILTING MODE IN THE FRX-8 CONFIGURATION
D. C. Barnes, A. Y. Aydemir, D. V. Andeson, A. I. Shestakov, and D. D. Schnack (LASL) In California Univ., Livermore. Lawrence Livermore Lab. Magnetic Fusion Energy 1980 12 p refs Prepared jointly with California Univ., Livermore. Lawrence Livermore Lab. (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

Experimentally, the tilting mode has not been observed in the field reversed theta pinch experiment FRX-8. Various estimates indicate that ideal MHD theory would predict such a mode to be unstable. An equilibrium configuration much like the typical FRX-8 plasma was computed and used to initialize two different evolutionary computations of the tilting displacement. A linearized MHD code, RIPPLE VI, and the nonlinear code, MALICE, both confirm the existence of the tilting mode and are in good agreement on its linear growth rate. Compressible MHD effects (as well as kinetic mechanisms ignored in the model) may nonlinearly stabilize this mode. Ampere's law was written in terms of a flux function and scalar pressure equilibria were assumed to compute the equilibrium configuration. Author

N81-28928# California Univ., Livermore. Lawrence Livermore Lab.
FIELD REVERSED EQUILIBRIA CREATED BY MONOENERGETIC IONS
John E. Brandenburg and Richard F. Post *In its* Magnetic Fusion Energy 1980 25 p (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

Analytical model of field revesal is presented. Rotational symmetry and z independence are assumed; the current being carried solely by monoenergetic ions of specified canonical angular momentum. Extending and further characterizing the results of Marx and Post, it is shown that within the reversal region, j varies directly as v/r. This result was used to derive an equation from which the self consistent magnetic field and the ion trajectories may be determined. Solutions to this equation show that strong field reversals can be obtained, in this model, for a/a sub o > 2.5 and that delta B/B sub o is approximately (1 + the square root of a/s), where a and s are the inner and outer radii of the layer, respectively, and a sub o is the ion gyroradius in the vacuum field B sub o. It is also shown that a diffuse or sharp current profile can be obtained depending on the choice of parameters. Work in progress is also presented which shows the modification of the equilibria by additional particle groups, higher order multipole vacuum fields, and currents due to Boltzmann electrons. Author

N81-28929# California Univ., Livermore. Lawrence Livermore Lab.
PARTICLE FLUID HYBRID SIMULATION OF FIELD REVERSAL IN A MIRROR PLASMA
Bruce I. Cohen and Thomas A. Brengle *In its* Magnetic Fusion Energy 1980 17 p ref (For primary document see N81-28924 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A12/MF A01

A one dimensional cylindrically symmetric hybrid simulation code was developed to investigate Ohkawa currents and field reversed mirrors. A fluid description is adopted for electrons with electron inertia ignored and quasineutrality assumed. The ions are modeled as particles. Coulomb friction between the ions and electrons is introduced by means of a simple Krook operator in the momentum equations. Ampere's and Faraday's laws are solved globally to provide self consistent magneto-inductive effects. For cold electrons on open field lines, electrostatic effects are strongly limited and can be ignored. On closed field lines, a flux tube averaged equation determines the electrostatic potential as a function of the magnetic flux. Orbit averaging of j in this equation greatly improves the statistical resolution. Simulations demonstrate that an ion impurity can allow the establishment of an Ohkawa current so that a net toroidal current can be produced by tangential neutral beam injection. Author

N81-28930# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENTS ON THE FLOW VELOCITY OF THE BETA II FIELD REVERSED PLASMA
E. H. A. Granneman (FOM Inst. for Atomic and Molecular Physics, Amsterdam), W. C. Turner, D. S. Prono, C. W. Hartman, J. Taska, A. C. Smith, Jr., and J. K. Nash *In its* Magnetic Fusion Energy

1980 21 p refs (For primary document see N81-28924 19-75) (Contract W-7405-eng-48)
Avail: NTIS HC A12/MF A01

A pressure bar probe consisting of a piezoelectric crystal clamped between two quartz rods was used to measure the plasma flow velocity as a function of radius. Typically at 80 cm from the gun, maximum pressures of 5 to 8 atm were found at r = or < 10 cm. At early times (15 microsec after gun break down) when the plasma flow pressure is high, the density is found to be low (approximately < 3.10 to the 14th power/cu cm). This indicates plasma with a high directed velocity (1 million m/s). This is confirmed by time of flight measurements made with magnetic probes. Later in time (after 25 microsec), the plasma flow pressure drops to values below 1 atm while the density reaches values of 3.10 to the 15th power/cu cm, indicating dense slow plasmas (r = < 100,000 m/s). After 30 microsec, the flow seems to stagnate completely. Because plasma flow velocities and/or temperatures can be deduced only the plasma density is known, the necessary complementary density measurements made with a HeNe laser interferometer are also given.
A.R.H.

N81-28931# California Univ., Livermore. Lawrence Livermore Lab.
MHD TILTING MODES FOR ARBITRARY PLASMA PRESSURE AND CONFIGURATION
J. H. Hammer *In its* Magnetic Fusion Energy 1980 15 p (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

A technique developed by Rosenbluth and Bussac was used to analytically examine the ideal MHD tilting instability of nearly spherical configurations. The extension was to an arbitrary (nearly spherical) separatrix shape that differs in general from the wall shapes and to arbitrary plasma Beta and current profiles. Results show that appropriate separatrix shaping as well as peaking the current near the vortex point give a factor of 5 improvement over stability conditions for the elliptical case. Walls close fitting at the poles can yield a factor of 2 improvement at best over a wall with delta constant and the same surface area. Extension of the wall inside the separatrix is stabilizing. After everything is optimized, the wall must still be order epsilon distant from the separatrix to insure tilting stability.
A.R.H.

N81-28932# California Univ., Livermore. Lawrence Livermore Lab.
STELLARMAK OR FRMT: A STELLARATOR - SPHEROMAK/FRM CONFIGURATION
C. W. Hartman *In its* Magnetic Fusion Energy 1980 15 p (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

The usual spheromak is a low aspect ratio case of the diffuse toroidal pinch with B (toroidal) = 0 on the outermost plasma surface. Diffuse pinch experiments show that reversed B (toroidal) is necessary to enter the quiescent regime. Reversed B (toroidal) can be achieved only by a spheromak by the addition of external transform windings (stellarator) windings. Controlled, surface-preserving ripple may allow steady state current to be driven by weak rotation of the plasma ions. The potential advantages of hybridization include (1) adding or reversing B (toroidal) increases shear and maximum, MHD-stable Beta; (2) vacuum generated shear may improve MHD stability to kink, tilt, and slip; and (3) electron trapping in a helical ripple may allow steady state with Beta sustained with directed neutral beams.
A.R.H.

N81-28933# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SIMULATONS OF BETA-II EXPERIMENT
J. K. Nash, J. L. Eddleman (International Power Technology Inc., Sunnyvale, Calif.), J. W. Shearer, and W. C. Turner *In its* Magnetic Fusion Energy 1980 20 p ref (For primary document see N81-28924 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A12/MF A01

Further applications of the MHD code HAM(1) were made to the Beta 2 magnetized coaxial plasma gun experiment at Livermore. Plasma gun rundowns were modeled for different gas fill pressures, capacitor bank energies, and ratio of electrode radii. Forced and passive reconnection of poloidal field lines is studied. Forced reconnection is accomplished with a fast pulsed coil near the gun muzzle. Passive reconnection is observed when a slow plasma divertor is placed between the electrodes, and when the gas density is reduced with an accompanying change in the gun geometry and capacitor bank.
Author

N81-28934# California Univ., Livermore. Lawrence Livermore Lab.
TRANSPORT IN FIELD-REVERSED MIRROR
Dan E. Schumaker, J. K. Boyd, S. P. Auerbach, and B. McNamara *In its* Magnetic Fusion Energy 1980 32 p (For primary document see N81-28924 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A12/MF A01

A code was written to describe the evolution of a field-reversed mirror. The plasma and magnetic field are assumed to be axisymmetric. The evolution calculation consists of two alternating steps, the solution of the 1-D transport equations and the solution of the 2-D equilibrium equations. The transport equations are the flux surface averaged transport equations of Braginskii. These transport equations advance quantities which are proportional to: (1) particle density, (2) electron entropy, (3) ion entropy, and (4) toroidal magnetic flux. In the absence of collisions these are adiabatic quantities.
Author

N81-28935# Pacific Gas and Electric Co., San Francisco, Calif.
THE MOVING-RING FIELD-REVERSED MIRROR REACTOR CONCEPT
A. C. Smith, Jr., G. A. Carlson (California Univ., Livermore. Lawrence Livermore Lab.), H. H. Fleischmann (Cornell Univ., Ithaca, N.Y.), T. Kammash (Michigan Univ., Ann Arbor), C. P. C. Wong (General Atomic Co.), and D. M. Woodall (New Mexico Univ., Albuquerque) *In* California Univ., Livermore. Lawrence Livermore Lab. Magnetic Fusion Energy 1980 23 p (For primary document see N81-28924 19-75)
Avail: NTIS HC A12/MF A01

A design iteration is presented for a moving ring mirror reactor which produces electric power by burning magnetically field-reversed rings of fusion fuel which are translated continuously down the v bore of a straight cylindrical reactor burner chamber. The eddy currents induced in the aluminum first wall structure as the rings move through the reactor produce a strong axial drag force on the rings. The wall drag balances the VB driving force all along the reactor burning chamber, permitting a constant ring axial speed of 15 m/s. The rings are radially stabilized by the multipole filed from horizontal conducting segments incorporated into the NbTi superconducting solenoid field coil design. The average central guide field is 6.25T and the average axial field gradient is 0.021 T/m. The low activation first wall, tritium breeding blanket, and shield designs take advantage of the reactor's cylindrical symmetry to minimize maintenance complexity. The plant operates on a steam cycle with a net plant output of 376 MW(e) and a recirculating power fraction less than 15%.
A.R.H.

N81-28936# Los Alamos Scientific Lab., N. Mex.
PROCEEDINGS OF THE THIRD SYMPOSIUM ON THE PHYSICS AND TECHNOLOGY OF COMPACT TOROIDS IN THE MAGNETIC FUSION ENERGY PROGRAM
Richard E. Siemon, comp. Mar. 1981 228 p refs Symp. held at Los Alamos, N. Mex., 2-4 Dec. 1980
(Contract W-7405-eng-36)
(LA-8700-C; CONF-80125) Avail: NTIS HC A11/MF A01

Various aspects of reactor technology are discussed with respect to compact toroids. Emphasis is also given to energetic particle rings, spheromak configurations (a mixture of toroidal and poloidal fields), and field reversed configurations (that contain purely poloidal field). For individual titles, see N81-28937 through N81-28983.

N81-28937# California Inst. of Tech., Pasadena.
RANDOM GAPPED WALL STABILIZATION FOR TRAVELLING MIRROR COMPRESSORS
Paul M. Bellan *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 1-3 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A technique for producing travelling magnetic mirrors in a particularly simple way was demonstrated.The scheme provided the possibility of three dimensional, constant field energy adiabatic compression of the magnetic mirror, and hence compression and heating of mirror confined reversed field configurations such as a compact torus, a reversed field theta/pinch, or a reversed field ion ring. The travelling mirror was produced by a double hump current impulse propagating in wave like fashion along a macroscopic delay line. The delay line was a long solenoid, the coils of which were connected to capacitors. Three dimensional adiabatic compression was achieved by gradually decreasing the bore and intercoil spacing of successive coils, while increasing their respective turns number. R.C.T.

N81-28938# Illinois Univ., Urbana. Fusion Studies Lab.
NUCLEAR ELASTIC SCATTERING EFFECTS ON FUSION BURNS IN COMPACT TORI
J. Galambos, J. DeVeaux, E. Greenspan, and G. H. Miley *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 4-7 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Preliminary results from two independent, though related studies of nuclear elastic scattering (NES) effects on characteristics of advanced fuel compact tori are presented. The effect of NES on the startup of a field reversed theta pinch moving plasmoid reactor are evaluated. Spatial effects of NES in field reversed mirrors are also examined. Particular emphasis is given to the effect of NES on fusion product orbits and the fraction of their energy being deposited in the plasma. DOE

N81-28939# Los Alamos Scientific Lab., N. Mex.
A COMPACT-TOROID FUSION REACTOR BASED ON THE FIELD-REVERSED THETA PINCH
R. L. Hagenson and R. A. Krakowski *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 8-11 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A dynamic plasma model and an overall systems approach were used to examine a compact toroid (CTOR) reactor embodiment that uses a field reversed theta pinch as a plasma source. The field reversed plasmoid was formed and compressionally heated to ignition prior to injection into and translation through a linear burn chamber, thereby removing the high technology plasmoid source from the hostile reactor environment. Stabilization of the field reversed plasmoid was provided by a passive conducting shell located outside the high temperature blanket but within the low field superconducting magnets and associated radiation shielding. A reactor concept was developed with a length below approximately 40 m that generates 300-400 MWe of net electrical power with a recirculating power fraction less than 0.15. R.C.T.

N81-28940# Pacific Gas and Electric Co., San Francisco, Calif.
THE MOVING-RING FIELD-REVERSED MIRROR PROTOTYPE REACTOR
A. C. Smith, Jr., G. A. Carlson (California Univ., Livermore. Lawrence Livermore Lab.), H. H. Fleischmann (Cornell Univ., Ithaca, N.Y.), W. Grossman, Jr. (New York Univ., N.Y.), T. Kammash (Michigan Univ., Ann Arbor), K. R. Schultz (General Atomic Co., San Diego, Calif.), and D. M. Woodall (New Mexico Univ., Albuquerque) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 12-17 refs Sponsored in part by Electric Power Research Inst. (For primary document see N81-28936 19-75)
(EPRI Proj. 922)
Avail: NTIS HC A11/MF A01

A prototype fusion reactor was designed based on magnetic field reversed plasma confinenent. A set of physics, technology, and mechanical design criteria were developed in order to make this concept attractive. Six major criteria guide the commercial prototype design. The prototype must: (1) produce net electricity decisively P sub net > 70% of P sub gross; (2) scale to an economical commercial plant and have small physical size; (3) have all features required of a correcial upgrade plant (H-3 breeding, etc.); (4) minimize exotic technology and maintenance complexity; (5) promise significantly lower safety hazards than fission plants (environmentally and socially acceptable); and (6) be modular in design to permit repetitive production of components. R.C.T.

N81-28941# Naval Research Lab., Washington, D. C.
A LINUS CT FUSION REACTOR BASED ON AXISYMMETRIC IMPLOSION OF TANGETIALLY-INJECTED LIQUID METAL
P. J. Turchi (Research Development Associates, Arlington, Va.), A. L. Copper, D. J. Jenkins, and E. P. Scannell (JAYCOR, Alexandria, (Va.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 18-23 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A liquid metal hollow cylinder, or linear, was formed and stabilized against the growth of Rayleigh-Taylor modes, by tangentially injection the linear or directly rotating the cylindrical pressure vessel. The rotating linear was then imploded by high pressure gas acting on pistons in contact with the linear outer surface. During the implosion, a closed field D-T plasma was created both in situ, and externally, and then transported into the hollow linear. The plasmoid was compressed to a final state where at thermonuclear burn occurs during the short dwell time at peak compression. R.C.T.

N81-28942# Burns and Roe, Inc., Oradell, N. J.
UTILITY REQUIREMENTS FOR FUSION POWER
R. J. Vondrasek, R. N. Cherdack, and Robert Gross (Columbia Univ.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 24-26 Sponsored in part by Electric Power Research Inst. Prepared in cooperation with Public Service Electric and Gas Co., Newark, N.J. (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The results described here were obtained as part of an on going EPRI fusion project. The project objectives are to develop a set of utility requirements for fusion power plants. A method for evaluating the relative merit of fusion concepts which incorporates consideration of these requirements was formulated. The utility requirements for commercial fusion were also identified. R.C.T.

N81-28943# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
TRACT FUSION REACTOR STUDIES
H. J. Willenberg, L. C. Steinhauer, and A. L. Hoffman *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 27-30 refs Sponsored in part by Electric Power Research Inst. (For primary document see N81-28936 19-75)
(EPRI Proj. 922-4)
Avail: NTIS HC A11/MF A01

A plasma concept called the triggered reconnection, adiabotically compressed torus was developed. A preliminary conceptual design study was carried out and key technology and utility oriented issues were investigated. The operational parameters as well as the design constraints are dicussed. R.C.T.

N81-28944# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
ON THE USE OF INTENSE ELECTRON AND ION BEAMS AND RINGS
Hans I. Fleischman *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 31-35 refs (For primary document see N81-28936 19-75)
(Contract DE-AS02-76ET-53017; EPRI Proj. 922-6)
Avail: NTIS HC A11/MF A01

Three distinctively separate ring configurations are considered for compact toroid (CT) applications. Included are the small orbit field reversed and the large orbit field reversed ion ring compressor. The basic advantages and disadvantages of requiring only simple external magnetic configuration and of not requiring material coils linking through the plasma ring are discussed. Various mixed-CT configurations involving the use of intense high energy

electron and/or ion beams are suggested with the aim to avoid some of the more disadvantageous characteristics. R.C.T.

N81-28945# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
CORNELL ION RING EXPERIMENTAL PROGRAM
J. B. Greenly, P. L. Dreike (Sandia Labs., Albuquerque, N. Mex.), D. A. Hammer, P. M. Lyster, Y. Nakagwa (Osaka City Univ.), and R. N. Sudan *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 36-39 refs Sponsored in part by ONR (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A numerical simulation was conducted in order to illustrate the way towards, and eventually achieve, the goal of providing ion rings for creating and/or maintaining, stabilizing, and heating toroidal confinement devices. The results of the simulation are discussed. R.C.T.

N81-28946# California Univ., Berkeley. Electronics Research Lab.
KINK MOTION OF LONG FIELD-REVERSING ION LAYERS
Douglas S. Harned *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 40-42 ref (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A two dimensional simulation code, AQUARIUS was developd and applied to ion layer kink motion. The code treats ions as particles and electrons as a massless fluid. The Darwin version of Maxwell's equations are used (i.e., the transverse displacement current is neglected). Maxwell's equations are coupled with the electron momentum equation (with inertial-terms neglected) by the assumption of quasineutrality to determine the time evolution of the electric and magnetic fields. The ion particles obey the equations of motion. Standard particle in cell techniques are employed to determine forces and accumulate currents. R.C.T.

N81-28947# California Univ., Irvine. Dept. of Physics.
PROPAGATION OF AN INTENSE ION BEAM TRANSVERSE TO A MAGNETIC FIELD
Hiroshi Ishizuka and Scott Robertson *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 43-46 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The results of an experiment are presented which show that the energetic ion beam of sufficient intensity will cross a magnetic field by polarization drift. It is suggested that an ion beam injected in this way, could be used to heat or drive currents in plasmas confined in toroidal magnetic fields. R.C.T.

N81-28948# California Univ., Irvine. Dept. of Physics.
THEORY OF PLASMA INJECTION INTO A MAGNETIC FIELD
William Peter and Norman Rostoker *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 47-51 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Cross field plasma motion is described for small and large gyroradius plasma beams. For a small gyroradius beam, preliminary calculations show that the cross field motion is driven by a dynamic Rayleigh-Taylor instability. For a large gyroradius beam, the plasma propagates across the field by means of a plasma drift. The possibility of injecting pulsed, neutralized ion beams into toroidal fields is assessed for the purpose of driving currents or of supplementary Tokamak heating. R.C.T.

N81-28949# California Univ., Livermore. Lawrence Livermore Lab.
CLASSICAL TRANSPORT IN FIELD REVERSED MIRRORS: REACTOR IMPLICATIONS
Steven P. Auerbach and William C. Condit *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 52-55 ref (For primary document see N81-28936 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01

The classical diffusion coefficients for particles and heat in field reversed mirrors was evaluated with reference to a class of Hill's vortex models. Two fairly surprising results were obtained: (1) the diffusion driven flow of particles and heat is finite at the X-points; and (2) the classical diffusion coefficients, which governs both particle and heat flux, is finite on the separatrix. R.C.T.

N81-28950# Princeton Univ., N. J. Plasma Physics Lab.
CALCULATION OF TILTING MODES IN A SPHEROMAK
M. S. Chance, R. L. Dewar, R. C. Grimm, S. C. Jardin, J. L. Johnson (Westinghouse Research and Development Center), and D. A. Monticello *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 56-59 refs (For primary document see N81-28936 19-75)
(Contract DE-AC02-76CH-03073)
Avail: NTIS HC A11/MF A01

Some of the fundamental instabilities associated with the spheromak configuration were investigated. Results indicate that these instabilities arise from the tendency of the plasma to tilt so as to align its magnetic moment with the externally imposed equilibrium field. The free energy driving this instability is large, arising from the interaction of toroidal plasma current with the currents in the external field coils. The global, almost rigid nature of the instability makes stabilization due to magnetic shear or finite gyration radius effects seem unlikely. R.C.T.

N81-28951# California Univ., Livermore. Lawrence Livermore Lab.
CRITICAL BIAS FIELDS FOR TILTING STABILITY IN THE BETA-2 EXPERIMENT
Hollis E. Dalhed *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 60-63 refs (For primary document see N81-28936 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01

The BETA-11 equilibrium code was investigated in terms of the effect on tilting modes of perfectly conducting walls which do not link the plasma. It is shown that the onset of the tilting mode is determined as a function of the bias magnetic field. R.C.T.

N81-28952# Naval Research Lab., Washington, D. C.
EXTERNAL TILTING OF SPHEROMAKS WITH LINE TYING
John M. Finn and Allan Reiman (Maryland Univ.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 64-67 ref (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The wall stabilization of the free boundary tilting mode for general shapes and current profiles was investigated. It was found that stability to external tilting improves dramatically with tailoring of the current profile. R.C.T.

N81-28953# New York Univ., N. Y. Inst. of Mathematical Sciences.
TURBULENT RELAXATION OF COMPACT TOROIDS
Eliezer Hameiri and James H. Hammer (California Univ., Livermore. Lawrence Livermore Lab.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 68-71 refs (For primary document see N81-28936 19-75)
(Contract W-7405-eng-48; Grant AF-AFOSR-2881-76)
Avail: NTIS HC A11/MF A01

A maximum entropy theory of the turbulent relaxation of compressible plasma is proposed. The entropy is maximized subject to a small set of constraints determined to be the only ones consistent with a general turbulent state. Taylor's minimum energy theory is recovered as a special case and relations to ideal MHD and tearing mode stability are discussed. Good agreement between field reversed theta pinch experiments and the theory is observed. R.C.T.

N81-28954# California Univ., Livermore. Lawrence Livermore Lab.
IDEAL MHD TILTING MODES FOR ARBITRARY PLASMA

PRESSURE AND CONFIGURATION
James H. Hammer *In* LASL Proc. of the Third Symp. on the Phys. Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 72-75 refs (For primary document see N81-28936 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01

The ideal MHD stability analysis of tilting modes is extended to arbitrary pressure and shape with the limitation that the separatrix and wall shapes must be nearly spherical. It is found that a conducting wall must in general be quite close to the separatrix (or even extended inside it) for stability. The stability conditions found show that improvements can be made by appropriate shaping of the separatrix and wall and by providing equilibrium current profiles peaked near the vortex point. M.G.

N81-28955# Columbia Univ., New York.
SIMULATION OF THE FORMATION OF THE PRINCETON SPHEROMAK
H. C. Lui, C. K. Chu, and A. Aydemir *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 76-79 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Several schemes with different field structure and current programming for the Princeton S-1 Spheromak are simulated with the aim of helping in its design and future operation. The method is based on numerically solving the single fluid compressible hydromagnetic equations with dissipation. M.G.

N81-28956# California Univ., Livermore. Lawrence Livermore Lab.
A COMPUTATIONAL COMPACT TORUS EXPERIMENT **c75**
B. McNamara, J. L. Eddleman, J. K. Nash, J. W. Shearer, and W. C. Turner *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 82-84 refs (For primary document see N81-28936 19-25)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01

The two dimensional (r, z, t) magnetohydrodynamic code, HAM, is used to model the performance of the magnetized, coaxial plasma gun injecting a plasma ring, in a copper flux conserving chamber. Results indicate that the gun produces two plasmas, a very dense one pressed radially outwards on the anode, and a lower density plasma around the cathode which accelerates ahead of the dense plasma to become the compact toroid. The dense plasma never really separates from the gun and falls back into it at the end of the discharge. The field line reconnection seems to be affected by plasma flow through the gap between the gun and the flux conserver and even more by plasma flow around the curvature of the expansion chamber. The plasma resistivity is anomalous in the reconnection regions. The efficiency of converting the capacitor bank energy into plasma and magnetic energy trapped in the toroid is only a few percent. The current and voltage variations have consideable effects on the final toroid produced. M.G.

N81-28957# Los Alamos Scientific Lab., N. Mex.
FORMATION AND EVOLUTION OF THE PS-1 SPHEROMAK
A. G. Sgro, H. C. Lui (Columbia Univ.), C. K. Chu (Columbia Univ.), and D. Winske (Maryland Univ.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 85-88 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The numerical analysis of spheromak formation and evolution by a two-dimensional MHD code is described. The initial results of the simulations approximately match the experimental data. Reconnection near the ends and subsequent axial contraction of the region of peak density are demonstrated. At late times the density peaks on the midplane ($z = 0$). M.G.

N81-28958# California Univ., Livermore. Lawrence Livermore Lab. National Magnetic Fusion Energy Computer Center.
REVERSED-FIELD MIRROR TRANSPORT CODE
D. E. Shumaker, J. K. Boyd, S. P. Auerbach, and B. McNamara *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 89-92 refs (For primary document see N81-28936 19-75)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01

A code (FRT) to model the evolution of a axisymmetric field-reversed mirror is described. The transport equations, which are one-dimensional, describe the plasma inside the separatrix. The code is used to model the Beta II magnetized coaxial plasma gun. The plasma is assumed to consist of hydrogen ions and electrons. A small percentage of impurity ions with fixed density profile is also included in the calculation. M.G.

N81-28959# Princeton Univ., N. J. Plasma Physics Lab.
TILTING-MODE-STABLE SPHEROMAK CONFIGURATION
K. Yamazaki (Nagoya Univ., Japan) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 93-96 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The external mode criterion for an arbitrary shaped spheromak is reviewed and the problem of finding the optimum spheromak configuration stable against both internal and external tilting instabilities is discussed. It is concluded that the oblate spheromak with a near conductive wall is stabilized against both tilting modes by adding the triangular or trapesoidal shaping of the plasma half cross-section. The prolate spheromak is also stabilized by the same shaping even if there is no conductive wall near the plasma boundary. M.G.

N81-28960# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PS-1 SPHEROMAK EXPERIMENT
H. Bruhns (Heidelberg Univ.), Y. P. Chong, G. C. Goldenbaum, G. W. Hart, and R. A. Hess *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 97-100 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The formation of oblate spheroidal plasmas utilizing an external mirror coil system is described.The system causes both flux surface closure and axial compression to make the configuration oblate. It is found that less radial compression and some axial compression can make the flux surface shape more oblate and reduce the tendency to the tilt. The net result of this is to reduce strong nonadiabatic compressional heating and thus require other heating means to be invoked immediately. A large source of thermal heating is the ohmic dissipation in the toroidal and poloidal currents. The major difficulty with ohmic heating is to overcome the radiation barrier associated with impurity ion line radiaton. The replacement of tungsten-copper alloy electrodes with carbon electrodes as a remedy to this problem is discussed. M.G.

N81-28961# Los Alamos Scientific Lab., N. Mex.
PHYSICAL PROPERTIES OF COMPACT TOROIDS GENERATED BY A COAXIAL SOURCE
L. Henins, H. W. Hoida, T. R. Jarboe, R. K. Linford, J. Marshall, K. F. McKena, D. A. Platts, and A. R. Sherwood *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 101-104 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Compact toroids (CTs) generated with a magnetized coaxial plasma gun are analyzed. CTs were generated and trapped in prolate and oblate cylindrically symmetric metallic flux conservers. The plasma and magnetic field properties are studied through the use of magnetic probes, Thomson scattering, interferometry, and spectroscopy. M.G.

N81-28962# Flinders Univ., Bedford Park (Australia).
A COMPACT TORUS CONFIGURATION GENERATED BY A ROTATING MAGNETIC FIELD: THE ROTAMAK
W. N. Hugrass (Cairo Univ.), L. R. Jones, and K. F. McKenna (LASL) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 105-108 refs (For primary document

see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The Rotamak concept is defined and experimental investigations of the Rotamak configuration are described. In the Rotamak concept, a rotating magnetic field is used to drive the steady toroidal current in a compact torus device. The magnetic field configuration of the Rotamak consists of the combination of a poloidal field (due to the toroidal plasma currents) and an externally generated 'vertical' field (required for equilibrium) with the applied rotating field which, in a sense, represents a time varying toroidal field. M.G.

N81-28963# California Univ., Livermore. Lawrence Livermore Lab.
FORMATION OF COMPACT TOROIDAL PLASMAS BY MAGNETIZED COAXIAL PLASMA GUN INJECTION INTO AN OBLATE FLUX CONSERVER
W. C. Turner, G. C. Goldenbaum (Maryland Univ., College Park), E. H. A. Granneman (Fom-Inst. Voor Atoom- en Molecuulfysica, Amsterdam), C. W. Hartman, D. S. Prono, J. Taska, and A. C. Smith, Jr. (Pacific Gas and Electric Co., San Francisco) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 113-118 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Initial results on the formation of compact toroidal plasmas in an oblate shaped metallic flux conserver are described. The plasma injector is a coaxial plasma gun with solenoid coils wound on the inner and outer electrodes. The electrode length is 100 cm, the diameter of the inner (outer) electrode is 19.3 cm (32.4 cm). Deuterium gas is puffed into the region between electrodes by eight pulsed valves located on the outer electrode 50 cm from the end of the gun. The gun injects into a cylindrically symmetrical copper shell which acts as a flux conserver for the time scale of experiments reported. Axial and radial arrays of probes were used for measurements of internal magnetic field profiles. A He-Ne (6328A) interferometer was used to measure line density. Photographs of the gun discharge were taken with a framing camera. Additional diagnostics were also used. M.G.

N81-28964# Miami Univ., Coral Gables, Fla. Dept of Physics.
HYDRODYNAMIC CONFINEMENT OF THERMONUCLEAR PLASMAS TRISPOS IIX
Daniel R. Wells, Paul Ziajka, and Jack L. Tunstall *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 119-123 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Experiments on fusion reactions produced by adiabatic compression of plasma vortex structures are discussed. the TRISOPS machine was modified by improving the preionization of the plasma and increasing the ring frequency of the conical theta-pinch coils. It is possible, with this modified machine, TRISOPS 8, to obtain ion temperatures of 1 keV before secondary magnetic compression and without any magnetic guide field. Ion temperatures of over 6 keV are obtained with secondary magnetic compression fields of 30,000 G. The plasma pressure in both instances, must be balanced by hydrodynamic forces. Ion temperatures and densities were measured by three different methods. All methods yield essentially the same results. The plasma was held in stable equilibrium for 100 micro secs and neutrons were produced for 70 micro secs. M.G.

N81-28965# Princeton Univ., N. J. Plasma Physics Lab.
FORMATION OF THE SPHEROMAK PLASMA BY A SLOW MAGNETIC CONDUCTION SCHEME
M. Yamada, H. P. Furth, W. Heidbring, A. Jaos, S. Jardin, M. Kabayashi, E. Salberta, J. Sinnis, and F. Wysocki *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 124-129 refs (For primary document see N81-28936 19-75)
(Contract DE-AC02-76CH-03073)
Avail: NTIS HC A11/MF A01

The development of an electrodeless slow spheromak formation technique to produce a 500 kA toroid of a = 25 cm, R = 40 cm is discussed. The formation scheme is based on a transformation of poloidal and toroidal magnetic flux into a plasma from a flux core. Results from the experimental demonstration of this approach are described. The resultant spheromak configuraton lasts about 15 to 20 microsec (< or = 100 tau sub Alf). Utilizing about 1/4 to 1/3 of the flux change from the core, the maximum toroidal and poloidal plasma currents are found to be roughly 20 kA and 50 kA respectively. M.G

N81-28966# California Univ., Livermore. Lawrence Livermore Lab. National Magnetic Fusion Energy Computer Center.
BALLOONING MODE GROWTH RATE DEPENDENCE N SEPARATRIX SHAPE FOR IDEALIZED EQUILIBRIA OF A FIELD REVERSED THETA PINCH
D. V. Anderson, H. L. Berk (Texas Univ.), and J. H. Hamer *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 130-133 ref (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

It is shown that increasing the retangularity of an equilibrium modifies the ideal MHD growth rates for ballooning (co-interchange modes). Results show trends and effects that can be estimated from the geometric differences of the profiles studied by very simple analyses based on the Alfven transit times. M.G.

N81-28967# Los Alamos Scientific Lab., N. Mex. Inst. for Fusion Studies.
LINEAR AND NON-LINEAR COMPUTATIONS OF THE IDEAL MHD TILTING MODE IN THE FRX-B CONFIGURATION
D. C. Barnes, A. Y. Aydemir, D. V. Andersn, A. I. Shestakov, and D. D. Schnack *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 134-317 refs Prepared in cooperation with Texas Univ., Austin and California Univ., Livermore, Lawrence Livermore Lab. (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

An equilibrium configuration like the typical field reversed-B plasma is computed and used to initialize two different evolutionary computations of the tilting displacement. A linearized MHD code, RIPPLE 5, and the nonlinear MHD code, MALICE, both confirm the existence of the tilting mode and are in good agreement on its linear growth rate. Compressive MHD effects (as well as kinetic mechanisms ignored in this model) may nonlinearly stabilize this mode. M.G.

N81-28968# Science Applications, Inc., La Jolla, Calif.
TWO-D TRANSPORT MODEL FOR FRC PLASMAS
R. N. Byrne and W. Grossman (New York Univ., N.Y.) *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 138-143 (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A one and one half dimensional simulation code is described which takes into account the complex topology of field reversed theta pinch plasmas including the separatrix and long flat profiles in the axial direction. The initial elongation can be specified arbitrarily. Representative results from compression studies and transport simulations are discussed. M.G.

N81-28969# Illinois Univ., Urbana. Fusion Studies Lab.
PARTICLE CONFINEMENT IN FR THETA P WITH LOSS-CONE-LIKE SCATTERING
Q. T. Fang and G. H. Miley *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 144-147 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A model that takes into account a loss-cone-like mechanism in field reversed theta pinch confinement was investigated. Confinement times predicted by this model fall into the range of values reported from the experiments FRX-A and B. Author

N81-28970# Los Alamos Scientific Lab., N. Mex.
RECONNECTION DURING THE IMPLOSION PHASE OF FIELD REVERSED CONFIGURATIONS
D. W. Hewett and C. E. Seyler *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic

Fusion Energy Program Mar. 1981 p 148-157 (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The implosion dynamics of reversed field confinement formation was simulated using an axisymmetric hybrid model consisting of kinetic ions and finite resistivity fluid electrons. The LASL FRC experments are well described by the model, which assumes quasineutrality, zero electron inertia, and no electromagnetic radiation. A.R.H.

N81-28971# JAYCOR, Del Mar, Calif.
ONE-DIMENSIONAL TRANSPORT MODELING OF FIELD REVERSED EXPERIMENT
S. Hamasaki and N. A. Krall *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 152-155 refs (For primary document see N81-28936 19-75)
(Contracts DE-AC03-79ET-53057; W-7405-eng-36)
Avail: NTIS HC A11/MF A01

A one-dimensional modeling of plasma diffusion in field reversed configurations, e.g., the LASL FRX experiment, is described, which incorporates some interesting two-dimensional features including: (1) leakage of particles through open field lines; (2) density and temperature equalization of the two different radial points which are connected by the magnetic flux lines in the closed field region; and (3) axial contraction or expansion. Specific numerical calculations of anomalous diffusion in FRX are carried out including these two-dimensional effects. The numerical predictions of plasma lifetime due to the anomalous diffusion roughly agree with the existing experimental data, if it is assumed that the experimental plasma rotation develops because of the plasma leakage. Author

N81-28972# Michigan Univ., Ann Arbor.
TRANSPORT, STABILITY AND REACTOR ASPECTS OF A HILL'S VORTEX FIELD-REVERSED GEOMETRY
T. Kammash *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 156-160 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A spherical Hill's vortex model was applied to a steady state field-reversed geometry (with a polidal magnetic flux only) and used to determine the transport and confinement time. The ratio of the plasma pressure to the pressure of the applied magnetic field (Beta value) was also ascertained. It is shown that the interchange modes arising from the interaction of the plasma pressure gradient and the unfavorable field curvature can be stabilized by the addition of a small toroidal field. Using the confinement times and Beta values obtained, the potential of such a confinement configuration as a reactor was examined by solving an appropriate set of global particle and energy balance equations for a D-T plasma with fast and thermal alpha particles taken into account. It was found that large volumes of Q (ratio of fusion power to injected power) are obtainable if a significant fraction of the fast (fusion) alphas escape before thermalization. Similar results are obtained for a pulsed system with a characteristic time equal to or large than the ion confinement time. In all instances, a near constant dependence of Q on Beta is observed for Beta > 1.0. A.R.H.

N81-28973# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
TWO-DIMENSIONAL MHD SIMULATION OF FIELD-REVERSED PLASMA FORMATION
R. D. Milroy and J. U. Brackbill *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 161-164 (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A reversed field theta-pinch was modelled with a two dimensional (r-z) magnetohydrodynamic computer code. Resistive diffusion of the magnetic field is calculated using either classical resistivity, or a form of anomalous resistivity. Separate electron and ion temperatures are calculated and the effects of both parallel and perpendicular thermal conductivity are included. The code employs a specially rezoned Lagrangian mesh which concentrates in regions of large current to resolve sharp gradients in the magnetic field. Plasma in contact with the radial wall is held at 1 eV and can flow freely parallel to the wall. Where the vacuum-plasma interface is not in contact with the wall, thermal insulation is assumed. Plasma at the open end boundary, 1/2 m from the theta-pinch end, is held at 1 eV, but can expand freely out of the calculation region. Author

N81-28974# Los Alamos Scientific Lab., N. Mex.
FLUX LOSS DURING THE FORMATION OF FRC
A. G. Sgro *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 169-171 (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A hybrid simulation in which the ions are kinetic while the electrons are an inertialess, charge-neutralizing fluid, is necessary when studying implosions in experiments such as FRX-B because of the presence of ion beams reflected off the magnetic piston. The presence of such kinetic features makes a fluid description questionable for the ions. Simulations were conducted to study the loss of the reversed flux associated with a field reverse configuration. Field profiles and the evolution of the trapped flux as a function of time imply that resistivity is anomalous and that a tenuous plasma between the CT and the wall carries a nonnegligible fraction of the current. About half of the anomalous joule heating is deposited directly to the ions. The fractional flux retention increases with increasing B(bias)/B(wall), up to some optimum value. A.R.H.

N81-28975# Los Alamos Scientific Lab., N. Mex.
SCALING LAWS FOR FRC FORMATION AND PREDICTION OF FRX-C PARAMETERS
Richard E. Siemon and R. R. Bartsch *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 172-175 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A semi-empirical method was developed to extrapolate the experimental results from FRX-B, a field-reversed theta pinch which generates a field-reversed configuration (a compact toroid with no toroidal field), to the larger size FRX-C. Even though there are many uncertainties about details of the dynamic processes by which an FRC is formed, the scaling exercise proved useful in identifying limitations in the original FRX-C design and the design was modified to have a lower voltage and larger capacitance. The goal of FRX-C remains unchanged: to test the confinement scaling of an FRC in a larger device over a wider range of temperatures. Of particular interest is the testing of possible MHD stability limits as the ratio of plasma size to gyro radius increases. Author

N81-28976# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
AXIAL SHOCK HEATING OF FIELD-REVERSED PLASMAS
Loren C. Steinhauer and Alan L. Hoffman *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 176-179 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A phenomenon observed in most reversed field-theta pinch experiments is the axial contraction of the plasma soon after the radial implosion. Experiments in the Soviet Union indicate that this contraction may cause significant shock heating if the theta pinch apparatus includes: (1) a multipole field pulsed on during field reversal to prevent momentary plasma-wall contact; (2) cusp coils at the pinch coil ends to delay the magnetic reconnection and subsequent axial contraction; and (3) fast mirror (trigger) coils at the theta pinch ends to trigger reconnection at the peak axial field. An experiment designed to study the use of octopole barrier fields to maximize the trapped reverse-bias flux, cusp coils to delay reconnection, and fast trigger coils to maximize the effectiveness of axial shock heating is described. A.R.H.

N81-28977# Los Alamos Scientific Lab., N. Mex.
FRC STUDIES ON FRX-B
W. T. Armstrong, J. C. Cochrane, J. Lipson, R. K. Linford, K. F. McKenna, A. G. Sgro, E. G. Sherwood, Richard E. Seimon, and

M. Tuszewski *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 180-183 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Field-reversed configurations on the FRX-B device are discussed with emphasis loss of bias on the phase of FRC formation and the use of barrier fields during the reversal phase to enhance trapping of bias flux. In addition to barrier field studies, results from different mirror configurations are also examined. The excluded-flux probe array and analysis of excluded-flux measurements to obtain the FRC separatrix profile is described. Preliminary results of FRX-B operation in an extended range of plasma parameters are included. A.R.H.

N81-28978# Los Alamos Scientific Lab., N. Mex.
THE INITIAL IONIZATION STAGE OF FRC FORMATION
R. J. Commisso, W. T. Armstrong, J. C. Cochrane, C. A. Ekdahl (Mission Research Corp., Albuquerque, N. Mex.), J. Lipson, R. K. Linford, W. G. Sherwood, Richard E. Siemon, and M. Tuszewski *In its* Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 184-187 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Theta pinch formation of a prolate compact torus that is confined by poloidal fields only (FRC) employs an initial bias field whose direction is opposite that of the main theta pinch field. Some fraction of the flux associated with this bias field eventually constitutes the closed field line flux of the FRC. Because the initial ionization is done in the presence of the bias field, the actual bias flux available at the time of applicaton of the main theta pinch field depends strongly on the initial ionization or preionization technique used. Experiments characterizing a previously used theta pinch preionization technique that employs a net field (bias plus ionization) null, or 'zero crossing', of the axial component of the magnetic field to break down the gas are described. Results of experiments designed to develop preionization techniques in which the gas breakdown is not accomplished by zero crossing are also reported. A.R.H.

N81-28979# Washington Univ., Seattle.
TRAPPING OF REVERSED BIAS FLUX IN A FAST-RISING THETA PINCH
S. O. Knox, H. Meth, F. L. Ribe, and E. Sevillano *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 188-191 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Experimental results on trapping of reversed-bias magnetic flux in a fast theta-pinch, the high beta Q machine, are reported. Both preionization and implosion phases were studied with measurements of the internal magnetic field, combined with excluded flux data and holographic interferometry. Reverse-field configurations with large values (> 0.8) of separatrix-to-coil ratio are produced. Author

N81-28980# Osaka Univ. (Japan). Plasma Physics Lab.
A keV COMPACT TOROIDAL PLASMA
S. Ohi, S. Okada, M. Tanjo, Y. Ito, T. Ishimura, and H. Ito *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Program Mar. 1981 p 192-195 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A compact toroidal plasma with field reversal configuration (FRC) is realized by the similar production method as that of a linear theta pinch with a negative bias field. The ion temperature of a linear theta pinch plasma produced in apparatuses of usual scale reaches to keV although its decay time is only the order of microseconds. On the other hand, a typical confinement time of the FRC plasmas is lower than those of linear theta pinch plasmas. Differences between FRC and linear theta pinch plasmas are considered. The confinement of a keV plasma with FRC was studied on the machine PIACE. A.R.H.

N81-28981# Royal Inst. of Tech., Stockholm (Sweden).
EXPERIMENTAL STUDIES OF LOW-LEVEL OSCILLATIONS IN A GLOBALLY-STABLE EXTRAP FIELD REVERSED CONFIGURATION
J. R. Drake *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 196-199 refs Sponsored in part by EURATOM (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

Experiments were carried out on the linear EXTRAP apparatus, a device in which the plasma is basically a straight Z-pinch, but the axial plasma current channel is along the axial null field line of an octupole vacuum magnetic field. The vacuum magnetic field is generated by currents in four rods. The rod current is antiparallel to the plasma current. All magnetic fields are transverse (poloidal) relative to the longitudinal axis of the discharge and the device becomes a field-reversed configuration if the plasma current is of sufficient magnitude and sufficiently localized. The duration of the quiet preceding the onset of the contained kink-like oscillations was found to be dependent on the plasma current and the filling pressure. The transition from the quiet condition to the oscillating state occurred very rapidly, in that the first fluctuation (indicating the onset of the low level oscillation state) had full amplitude. A.R.H.

N81-28982# General Atomic Co., San Diego, Calif.
THE BUMPY Z-PINCH
Torkil H. Jensen and Ming Sheng Hu *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 200-203 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

The 'Bumpy Z-Pinch' is a compact torus-like configuration which may be easy to establish and maintain indefinitely. A simple version of the configuration is axisymmetric. It contains regions of closed and open field lines. In a region of closed field lines, the topology is much like that of a Tokamak; such regions of closed field lines link a region of open field lines around the axis of symmetry. Assuming that the plasma spontaneously maintains a Taylor equilibrium, it is possible to establish and indefinitely maintain regions of closed field lines by driving an axial current through the plasma in the region of open field lines. The ratio between the total axial driven current and the total azimuthal current in a Tokamak-like region of closed field lines may in principle be made arbitrarily small. Author

N81-28983# Prometheus II Ltd., College Park, Md.
THE PLASMAK: ITS UNIQUE STRUCTURE, THE MANTLE
P. M. Koloc and J. Ogden *In* LASL Proc. of the Third Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program Mar. 1981 p 204-207 refs (For primary document see N81-28936 19-75)
Avail: NTIS HC A11/MF A01

A compound plasma (plasmak) includes a toroidal plasma or kernel plasma similar to the classical force free spheromak. The region within the mantle plasma including the vacuum field and the plasma ring is designated the kernal. The kernel plasma is confined by the vertical field generated in a closely fitting, highly conducting ellipsoidal shell or mantle within a gas blanket. This contrasts with other spheromaks and CT configurations in which external vertical field coils are used to confine the plasma. The advantages and properties of the mantel are discussed. A.R.H.

N81-28984# General Atomic Co., San Diego, Calif.
RADIO FREQUENCY CURRENT DRIVE IN FUSIONING PLASMA
C. Chu and D. Bhadra Feb. 1981 8 p refs Presented at the 4th Topical Conf. on Radio Frequency Plasma Heating, Austin, Tex., 9 Feb. 1981
(GA-A-16194; CONF-810214-4) Avail: NTIS HC A02/MF A01

Radio frequency power is used to prohibit the fusion-produced alpha-particles from slowing down isotropically, or to push the alpha-particles in a preferential direction and this forms an alpha-particle beam. As a result, a net plasma current (Ohkawa current) may be generated if the fuel ions have Z not equal to 2. The power requirement is estimated and the efficiency is found to be comparable to beam and other RF current-drive schemes. Since the alpha-particles are born in the central hot

core of the reactor, the current profile is naturally peaked in the center. DOE

N81-28985# Oak Ridge National Lab., Tenn. Physics Div.
US JAPAN WORKSHOP ON ATOMIC COLLISION DATA FOR FUSION
D. H. Crandall, ed., P. M. Hafford, ed., and Y. Itikawa, ed. (Nagoya Univ., Japan) Apr. 1981 82 p refs Workshop held at Boulder, Colo., 27-31 Oct. 1980
(Contract W-7405-eng-26)
(ORNL/TM-7675) Avail: NTIS HC A05/MF A01

A workshop between data centers which are compiling and evaluating atomic collision data for fusion interests is reported. Procedures used in evaluation and selection of recommended cross sections were reviewed, and technical criteria and specific collaborative efforts for improving the data selection process were identified. The application of atomic data in Tokamaks and inertial confinement, the status of electron ion scattering and ion atom scattering efforts, and activities in the related area of atomic structure and plasma wall interactions were reviewed. The operation of data centers, the manner of exchanging data, and comparison of data selected for six specific collision reactions were discussed. A joint compilation of recommended cross sections for electron impact excitation and electron capture from atomic hydrogen was planned. Abstracts of the presentations and discussions are presented. DOE

N81-28986# Westinghouse Electric Corp., Pittsburgh, Pa. Dept. of Fusion Power Systems.
FEASIBILITY OF RECYCLING THORIUM IN A FUSION-FISSION HYBRID/PWR SYMBIOTIC SYSTEM
J. M. Josephs (Cornell Univ., Ithaca, N.Y.) 31 Dec. 1980 54 p refs
(Contract DE-AC02-77ET-51010)
(DOE/ET-51010/9) Avail: NTIS HC A04/MF A01

A study was made of the economic impact of high levels of radioactivity in the thorium fuel cycle. The sources of this radioactivity and means of calculating the radioactive levels at various stages in the fuel cycle are discussed and estimates of expected levels are given. The feasibility of various methods of recycling thorium is discussed. These methods include direct recycle, recycle after storage for 14 years to allow radioactivity to decrease, shortening irradiation times to limit radioactivity build up, and twhe use of the window in time immediately after reprocessing where radioactivity levels are diminished. An economic comparison is made for the first two methods together with the throwaway option where thorium is not recycled using a mass energy flow model developed for a CTHR (Commercial Tokamak Hybrid Reactor), a fusion fission hybrid reactor which serves as fuel producer for several PWR reactors. DOe

N81-28987# California Univ., Livermore. Lawrence Livermore Lab.
MFTF-B PHYSICS REQUIREMENTS
G. D. Porter and K. I. Thomassen 25 Mar. 1981 33 p refs
(Contract W-7405-eng-48)
(UCID-18798) Avail: NTIS HC A03/MF A01

The specifics of the physics requirements for the magnetic fields, diagnostics, particle and energy sources, and vacuum environment for the MFTF-B experiment are described. The specific physics objectives for MFTF-B are to: (1) demonstrate the improvement in Q with increasing potential well depth, in the range of $0.1 < Q > 1$; (2) explore radial transport in the central cell and determine its influence on confinement; (3) explore microinstabilities in the end plugs and means of controlling them; and (4) explore the beta limits imposed by magnetohydrodynamic stability. E.D.K.

N81-28988# California Univ., Livermore. Lawrence Livermore Lab.
FLEXIBILITY OF MFTF-B FOR THERMAL-BARRIER MODIFICATIONS AND AXISYMMETRIC UPGRADES
K. I. Thomassen 25 Mar. 1981 25 p refs
(Contract W-7405-eng-48)
(UCID-18948) Avail: NTIS HC A02/MF A01

Flexibility in MFTB-B is achieved partly by using the margins in particle and energy control designed into the machine and partly by making modest changes based on results obtained in TMX Upgrade. This latter flexibility is permitted by the schedule for vessel construction and component fabrication. The changes one might expect were determined by an examination of the processes involved in creating a thermal barrier and by speculating on the range of outcomes from TMX Upgrade experiments. DOE

N81-28989# Oak Ridge National Lab., Tenn. Engineering Physics Div.
ANALYSIS OF THE GCFR RADIAL BLANKET AND SHIELD INTEGRAL EXPERIMENT Final Report
D. T. Ingersoll and L. R. Williams Apr. 1981 103 p refs
(Contract W-7405-eng-26)
(ORNL-5756) Avail: NTIS HC A06/MF A01

An integral experiment was peformed for verification of radiation transport methods and nuclear data used in the design of the radial shield for the proposed gas-cooled fast breeder reactor demonstration plant. The experiment (GCFR) consisted of integral and spectral measurements of the neutron and gamma-ray flux transmitted through slabs of materials which modeled a GCFR-type radial blanket and radial shield. Both UO2 and ThO2 blankets were investigated as well as several shield designs comprising stainless steel, graphite, and boronated graphite. DOE

N81-28990# Brookhaven National Lab., Upton, N. Y.
OPTICAL EMISSION STUDIES OF REACTIVE SPECIES IN PLASMA DEPOSITION
F. J. Kampas and R. W. Griffith 1981 6 p refs Presented at the Conf. on Tetrahedrally Bonded Amorphous Semiconductors, Carefree, Ariz., 12 Mar. 1981
(Contract DE-AC02-76CH-00016)
(BNL-29161; CONF-810331-2) Avail: NTIS HC A02/MF A01

Optical emission studies of the glow discharge deposition of a-Si:H alloys reveal the presence of reactive species derived from process gases and impurities. Studies of the dependences of emission intensities upon deposition parameters elucidate the mechanisms of formation of these species. Effects of impurities detected by emission spectroscopy upon a-Si:H film electronic properties are discussed. A model of the chemical reactions involved in film growth is presented. DOE

N81-28991# Ogden (Joan M.), Princeton, N.J.
COMPUTER SIMULATION OF LOWER-HYBRID HEATING IN TOKAMAKS Final Report
J. M. Ogden 29 Apr. 1981 43 p refs
(Contract DE-AC01-80ER-53106)
(DOE/ER-53106/T1) Avail: NTIS HC A03/MF A01

A simple quasilinear model was added of lower hybrid heating to the BALDUR 1-D Tokamak transport code. The program was used to simulate PLT and the INTOR reactor design. For PLT a temperature increase of approximately 2 keV/kW of RF input power was predicted. Quasilinear theory gave slightly less heating than linear theory because of greater electron edge losses. DOE

N81-28992# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
PLASMA TRANSPORT IN A SIMULATED MAGNETIC-DIVERTOR CONFIGURATION Ph.D. Thesis
Clifford M. Strawitch Mar. 1981 207 p refs
(Contract DE-AS02-76ET-53051)
(DOE/ET-53051/20) Avail: NTIS HC A10/MF A01

The transport properties of plasma on magnetic field lines that intersect a conducting plate are studied experimentally in the Wisconsin internal ring D.C. machine. The magnetic geometry is intended to simulate certain aspects of plasma phenomena that may take place in a Tokamak divertor. It is found by a variety of measurements that the cross field transport is nonambipolar; this may have important implications in heat loading considerations in Tokamak divertors. The undesirable effects of nonambipolar flow make it preferable to be able to eliminate it. However, it is found that though the nonambipolarity may be reduced, it is difficult to eliminate entirely. The plasma flow velocity parallel to the magnetic field is found to be near the ion acoustic velocity in all cases. The experimental density and electron temperature profiles are compared to the solutions to a one dimensional transport model that is commonly used in divertor theory. DOE

N81-28993# Department of Energy, Washington, D. C.
SOME ASPECTS OF THE STUDY OF GAS-DISCHARGE PLASMA AND PRODUCTION OF HIGH MAGNETIC FIELDS
V. G. Novitskii, ed. 1981 181 p Transl. into ENGLISH of the book "C Nekotorye Voprosy Issled. Gazorazryadnoi Plazmi i Sozdaniya Silnykh Magnitnykh Polei" Leningrad, Izdatelstvo Nauka, 1970 181 p
(DOE-Tr-73) Avail: NTIS HC A09/MF A01

The subjects discussed include three phase plasmatrons, their operational characteristics, and the nature of the physical processes occurring in the arc chamber. The results of experimental and theoretical research on gas discharge plasma, conduction phenomena in flowing gaseous plasmas, and energy balance and radiation in the case of gas discharge plasma are also included. The stability of arcs, the effect of the transverse genetic field and gas flow on breakdown voltages, the electrode phenomena, and the distribution of current on the electrodes are considered. Results of research on the conditions of electric arc contraction and the characteristics of a contracted arc are given. The problems associated with the production of high magnetic fields and the use of superconducting materials to this end are discussed. The experience gained in the design and fabrication of superconducting magnets and cryostats is described. The results of design calculations for magnetic systems of the Bitter type are also presented. DOE

N81-28994# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
EXPERIMENTS ON THE CRITICAL IONIZATION VELOCITY INTERACTION IN WEAK MAGNETIC FIELDS
N. Brenning Nov. 1980 20 p refs Sponsored by Swedish National Science Research Council
(TRITA-EPP-80-10; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

The critical ionization velocity interaction was studied in a configuration with a magnetized plasma stream colliding with a stationary neutral gas cloud. An electrodeless plasma gun of the conical pinch type was used. In all previous experiments of this kind the magnetic field has had a component transverse to the plasma flow and has been strong in the sense that the electron gyro frequency has exceeded or been approximately equal to the plasma frequency. Both these conditions play an important role in existing theories of the critical velocity interaction. A determination whether or not such interaction is possible when one of these conditions is not fulfilled, namely when the magnetic field is weak, was sought. Experiments were performed both with a transverse and longitudinal (aligned with the plasma flow) magnetic field. It is found that in both cases the critical ionization velocity effect either disappears or becomes too small to be distinguishable among classical collisional processes.
Author (ESA)

N81-28995# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
OPTIMUM DESIGN OF A MICROWAVE INTERFEROMETER FOR PLASMA DENSITY MEASUREMENTS
L. Lindberg and A. Eriksson Nov. 1980 19 p refs
(TRITA-EPP-80-11; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

Theoretical and practical problems arising in the application of microwave interferometry to density measurements on transient plasmas are discussed. The conditions for unambiguous measurements in a density range as wide as possible are analyzed. It is shown that the initial zero adjustment of the interferometer bridge recommended in many text books is the worst possible choice of initial condition when the aim is high initial sensitivity at low densities. The analytic expressions needed for unambiguous evaluation of any phase shift from a few degrees to several times pi (counting of fringes) are derived. The practical design of the interferometer circuit and its inherent error sources due to reflection and non-ideal component properties are discussed. The results are applied to an interferometer operating at 80 GHz used on a pulsed plasma experiment. Author (ESA)

N81-28996# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
CYCLOTRON RADIATION FROM THERMAL AND NON-THERMAL ELECTRONS IN THE WEGA-STELLARATOR
H. W. Piekaar and W. R. Rutgers Nov. 1980 27 p refs Sponsored by Euratom and Nederlanse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-80-128) Avail: NTIS HC A03/MF A01

Emission spectra were measured with a far infrared spectrometer and InSb detectors. When the plasma loop voltage is high, runaway electrons give rise to intense broadband emission. Runaway particles can be removed by increasing the plasma density. For low loop voltage discharges the electron temperature profile was deduced from thermal emission. In spite of the low E field, runaway particles are still created and pitch-angle scattered. From nonthermal emission, the energy and number of nonthermal particles is calculated and found to be in agreement with existing theories. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-28997 British Library Lending Div., Boston Spa (England).
A THERMOCHEMICAL APPLICATION OF THE LATTICE THEORY
M. Born Jan. 1981 16 p refs Transl. into ENGLISH from Verhandl. der Deut. Physikalischen Ges. (West Germany), v. 21, no. 1/2, 1919 p 13-24
(BLL-RTS-12056) Avail: British Library Lending Div., Boston Spa, England

Assuming that the cohesion forces of regular crystals are of a purely electrical origin the relationship between lattice energy, heat effect, and ionization is investigated. M.G.

N81-28998 Princeton Univ., N. J.
CHEMISORPTION AND MAGNETIC SUPERCONDUCTORS: SOME ORIGINAL RESULTS ON TWO PROBLEMS IN CONDENSED MATTER PHYSICS Ph.D. Thesis
Henry Stewart Greenside 1981 181 p refs
Avail: Univ. Microfilms Order No. 8114020

A Hamiltonian for two interacting magnetic impurities is reinterpreted and applied to the chemisorption of molecular hydrogen on sp band metals. Simple overlayer and mixer layer geometries are studied for the observed c(2 x 2) structure of atomic Cl adsorbed on the Ag(001) surface. A self consistent, Gaussian, linear combination of atomic orbitals (LCAO) technique with a local exchange correlation potential is used. An efficient way to calculate nonlocal pseudopotential matrix elements in a Gaussian basis is presented. The possible coexisting magnetic superconducting phases are discussed and analyzed. Besides a circularly polarized spiral state and a spontaneous vortex state, it is shown that a spin density wave may exist. Dissert. Abstr.

N81-28999 Pennsylvania State Univ., University Park.
THE HIGH RESOLUTION IMAGING ATOM-PROBE WITH APPLICATION TO NICKEL PLATINGS Ph.D. Thesis
Michael Martinka 1981 180 p
Avail: Univ. Microfilms Order No. 8112823

The development and performance of a high resolution imaging atom-probe time-of-fight mass spectrometer, are described as well as application to electro- and electroless nickel-phosphorus platings. A preliminary application to the chemistry of hydrogen adsorbed on metallic solids displayed crystallographically and atomically specific variations in the distribution of adsorbed hydrogen over an undisturbed rhodium surface in an applied electric field. The mass spectra of as-deposited Ni electroplate show it to be 99+% pure, while field-ion micrographs shows boundaries of atomic width between impinging crystals. The mass spectra of as-deposited Ni-P(2.7%) electroless plate and the annealed Ni3P-Ni phase mixture show phosphorus content in agreement with expected values, while expanded Ni-P spectra show oxygen and a trace amount of chlorine. Micrographs, after annealing, show an ordered overlayer rich in phosphorus indicating the segregation of phosphorus to the surface during the transformation to Ni3P-Ni. The existence and coincidence of boundaries indicate ·Ni-P is not totally

amorphous, in the sense of a liquid, as was previously thought.
Dissert. Abstr.

N81-29000 California Univ., Berkeley.
A15 SUPERCONDUCTORS THROUGH DIRECT SOLID-STATE PRECIPITATION: V3Ga AND Nb3Al Ph.D. Thesis
Minghwei Hong 1980 177 p
Avail: Univ. Microfilms Order No. 8113071

Ingots weighing as large as 30-50 gms of V-(14 approximately 19 at %) Ga and Nb-(13 approximately 22 at %) Al were prepared by arc-melting, homogenized, quenched, warm-rolled over 99% into tape, and aged at temperatures in the range 600 C - 1000 C to precipitate the superconducting A15 phase. In the V-Ga system, transmission electron microscopy (TEM) studies revealed the A15 precipitates in an elongated form, however, for the Nb-Al samples, deformed and aged at 750 C, TEM studies revealed A15 precipitation in fine equi-axed particles which formed as a semi-continuous network over sub-grain boundaries formed by the recovery deformation-induced dislocations. In the V-Ga system, the maximum critical transition temperature initially increased with aging time and passed through a distinct maximum. In the Nb-Al system, the critical transition temperature increased with aging time to a plateau, and then increased again to a second plateau. Dissert. Abstr.

N81-29001 California Univ., Berkeley.
SURFACE, INTERFACE, AND TOTAL ENERGY OF SOLIDS Ph.D. Thesis
Jisoon Ihm 1980 233 p
Avail: Univ. Microfilms Order No. 8113079

A self consistent pseudopotential method is applied to calculate electronic structures for various types of solids. Much of the emphasis is placed on the study of the total energy of the systems involved and derivative of the energy with respect to structural degrees of freedom. The results are compared with available experiments data and the resulting good agreement with experiments indicates that this technique is very promising for studying structural properties of solids. Electronic structures of semiconductor surface are investigated. The existence and the character of surface states of the ideal Ge and diamond (III) surfaces are studied. Also, the electronic structures of various interface systems are studied. The role of metal induced gap states in the Fermi level planning is done for the Pd monolayer on the Si(III) surface. To study the structural properties of solids quantitatively, a momentum space formalism for the total energy of solids using pseudopotentials is developed. Dissert. Abstr.

N81-29002 California Univ., Berkeley.
FLOW PROPERTIES OF LIQUID 3He BELOW 5 MILLIDEGREES Ph.D. Thesis
James Philip Eisenstein 1980 169 p
Avail: Univ. Microfilms Order No. 8113021

Hydrodynamic experiments in the normal and superfluid phases of liquid He - 3 are described. These investigations were performed at saturated vapor pressure at temperature between 0.5 mK and 5 mK. In the normal phase the viscosity was measured and the effect of quasiparticle mean free path on hydrodynamic was quantitatively observed. The superfluid experiments concern critical currents are the B-phase, magnetic effects on bulk hydrodynamics, and the question of intrinsic dissipation effects in the superfluid. Dissert. Abstr.

N81-29003 Cincinnati Univ., Ohio.
CHEMICAL VAPOR DEPOSITION, DOPING AND CHARACTERIZATION OF BORON-PHOSPHIDE Ph.D. Thesis
Shyam Gopal Garg 1981 178 p
Avail: Univ. Microfilms Order No. 8115297

Boron phosphide was deposited on silicon and sapphire substrates using a mixture of diborane, phosphine and purified hydrogen in a pancake type epitaxial reactor. The films deposited were of high quality. Temperature of deposition and flow rates of the constituent gases were varied during the deposition. The early growth was observed. Single crystal films of high resistivity were obtained on silicon substrates. The heterostructure between BP and SI was studied. Current conduction experiments were performed. It was concluded that a tunneling mechanism was the major contributing factor. A very low value for ionicity was established. The real part of the refractive index of boron phosphide was determined the band structure is discussed, and boron phosphide compared with other III-V compounds and group 4 elements. The films was doped with zinc, beryllium, and silicon. Conductivity was determined as a function of temperature.
Dissert. Abstr.

N81-29004 California Univ., Los Angeles.
A STUDY OF RARE EARTH LUMINESCENCE AND ENERGY TRANSFER IN IONIC LANTHANIDE CRYSTALS Ph.D. Thesis
Roger Myron Brewer 1981 157 p
Avail: Univ. Microfilms Order No. 8113819

The Ce3+ and Nd3+ luminescence and energy transfer properties in ionic lanthanide crystals are studied. An investigation of the factors necessary for characterizing the energy transfer process, such as Ce-to-Nd energy transfer efficiencies and mechanism, Ce and Nd concentration dependences, and the concentration dependence of Nd luminescence is reported for two lanthanide crystals: lanthanide pentaphosphate, LnP5O14, and lanthanide sodium sulfate, LnNa(SO4)2H2O. Dissert. Abstr.

N81-29005 Oklahoma State Univ., Stillwater.
OPTICAL PROPERTIES OF Ni2+ AND RADIATION DEFECTS IN MgF SUB 2 AND MnF SUB 2 Ph.D. Thesis
Leonard Norman Feuerhelm 1980 89 p
Avail: Univ. Microfilms Order No. 8113309

The radiation defects in pure MgF2 were made by observating the polarized absorption, luminescence, and excitation spectra in electron-irradiated MgF2. Additionally, studies of the absorption, emission, excitation, and temperature dependence of the lifetimes of transitions in nickel-doped MgF2 and MnF2 were accomplished, as well as the observation of radiation effects on these crystals. The absorption band at about 320 nm in irradiated MgF2 is identified to be due to the F2(D2b) center, and to have an emission at about 450 nm. Analysis of the temperature dependence of this band indicates a dominant phonon mode of 255 cm(-1) for the excited state. The F2(C1) center is identified with an absorption of about 360 nm and an emission of 410 nm. An absorption peak at 300 nm, for which no corresponding emission was found, is tentatively identified to be the F3-center, and to have a dominant phonon mode of 255 cm(-1). The temperature dependence of the lifetimes of transitions in nickel-doped MgF2 is analyzed by the quantum mechanical single configuration coordinate model of Struck and Fonger, and a complete configuration coordinate model is made for this crystal. Similar studies are made in MnF2:Ni. Dissert. Abstr.

N81-29006 Princeton Univ., N. J.
OXYGEN AND ALUMINUM OVERLAYERS ON GaAs(110): A LEED ANALYSIS Ph.D. Thesis
Davoud Kanani 1981 110 p
Avail: Univ. Microfilms Order No. 8114117

Low energy electron diffraction (LEED) is used for a quantitative description of the atomic structures of gas (oxygen) and metal (Al) overlayers on GaAs(110). The theoretical basis of LEED is rapidly reviewed. A detailed description of the present knowledge of the electronic and atomic structures of the clean GaAs(110) surface is given as a starting point for the study of the overlayers. The exposition to molecular and excited oxygen (1000 to 10,000 L) results in a transformation of the measured intensity LEED profiles indicating the formation of a thin (1 to 3A) amorphous oxide layer. The rate of formation of this layer increases with excited oxygen, indicating a process involving the dissociation of molecular oxygen. The room temperature deposition of Al (1/2 to a few monolayers) produces a mostly disordered overlayer. Annealing results in a new ordered structure: Al replaces Ga in subsurface atomic layers and Ga is thermally desorbed from the surface during annealing. The dynamical LEED analysis leads to a structure for which Al replaces Ga in the second layer. Dissert. Abstr.

N81-29007 Rutgers - The State Univ., New Brunswick, N. J.
INVESTIGATION OF FOURTH SOUND PROPAGATION IN He2 IN THE PRESENCE SUPERFLOW Ph.D. Thesis
Yocheved Eva Andrei 1980 147 p
Avail: Univ. Microfilms Order No. 8115194

The temperature dependence of a superflow-induced downshift of the fourth sound velocity in helium 2 confined in various

restrictive media was measured. The magnitude of the downshift strongly depends on the restrictive medium, whereas the temperature dependence is universal. The results are interpreted in terms of local superflow velocities approaching the Landau critical velocity. This model provides an understanding of the nature of the downshift and correctly predicts its temperature dependence. The Landau excitation model, even when used at high velocities yields good agreement with experiment when a first order correction is introduced to account for these interactions between elementary excitations. Foruth sound-like propagation in helium 2 in a grafoil-filled resonator was observed. The sound velocity was found to be more than an order of magnitude smaller than that of ordinary fourth sound. This significant reduction is explained in terms of a model in which the pore structure in grafoil is pictured as an ensemble of coupled Helmholz resonators. Dissert. Abstr.

N81-29008 California Univ., Berkeley.
INITIAL STAGES OF VAPOR-LIQUID-SOLID MECHANISM OF CRYSTAL GROWTH Ph.D. Thesis
Tai-Chan Donald Huo 1980 59 p
Avail: Univ. Microfilms Order No. 8113076

The vapor-liquid-solid (V-L-S) crystal growth mechanism of the Au/Si system was studied at different temperatures by use of the transmission on microscope (TEM) and scanning electron microscope (SEM) with hot stages. The imperfection of the native silicon oxide films was detected by a gold decoration technique and the alloying process was directly observed by TEM. In the initial stages liquid Au/Si triangles formed beneath the native silicon oxide film at temperatures above the Au/Si eutectic. When silicon was deposited on top of the Au/Si layer above 370 C, epitaxial silicon films grew under these triangles. A model based on these observations is proposed to explain low temperature V-L-S growth. In order to obtain large area epitaxial growth, a technique based on this model was developed which prevents formation of discontinuous Au/Si globules. A model is proposed to explain the growth mechaism of Au/Si whiskers which were observed to grow from a sputtered Au/Si substrate.
Dissert. Abstr.

N81-29009 Minnesota Univ., Minneapolis.
BULK AND SURFACE EFFECTS ON NOISE AND SIGNAL BEHAVIOR OF SEMICONDUCTOR DEVICES Ph.D. Thesis
Renuka Prasad Jindal 1981 143 p
Avail: Univ. Microfilms Order No. 8115003

Generations recombination noise, flicker noise and thermal noise in case of an MOS field effect transistor for bulk and surface trapping is examined. The existing model for number fluctuations and the empirical formula for mobility fluctuations of flicker noise are reviewed. A physical model is proposed to justify the mobility fluctuation empirical formula. Correlated mobility and number fluctuations are also examined, at the surface and in the bulk. The autocorrelation function for thermal noise is determined in the absence of the zero point energy term using the corrected independent sublayer conduction model and the effect of strong transverse electric field on the MOSFET channel thermal noise is quantified. The signal modeling of finite and infinite semiconductor samples at equilibrium is also discussed. Determination of potential, field and charge distribution throughout the sample is emphasized. It is demonstrated that the step junction and the surface proble have identical solutions. Partial solutions are developed for finite step junction and surface problems by enunciating a principle of extended charge neutrality. The role of extrinsic Debye length for scaling in semiconductor modeling work is examined. Dissert. Abstr.

N81-29010 Texas Univ. at Dallas.
REAL SPACE INTEGRATION TECHNIQUES APPLIED TO CALCULATION OF THE ELECTRON ENERGY STATES IN SMALL METALLIC CLUSTERS Ph.D. Thesis
Paul Geoffrey Rudolf 1980 121 p
Avail: Univ. Microfilms Order No. 8113929

Real space integration techniques are applied to the calculation of electron energies in small clusters of atoms. Nickel is used as a representative metal. Clusters of up to six shells and seventy nine atoms are evaluated. Muliken population analysis is used to separate localized surface states from bulk-like states. The fact that atoms deep in the cluster are surrounded by neighbors is found to lead to a screening effect by which deeply situated electrons are unaware of the finite nature of the cluster. Surface charge polarization, due to the movement of electrons inward to fill deeper states within the cluster, may be producing screening for atoms which are not otherwise screened by surrounding neighbors. Screening is found to be suprisingly rapid in the light of the free electron nature of conduction electrons in metals. Surface states are shown to be very important for small clusters. Clusters as small as four shells are found to reproduce bulk crystalline behavior fine structure in he density of states when surface states are excluded. Dissert. Abstr.

N81-29011# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE PHOTOACOUSTIC EFFECT IN SEMICONDUCTORS; EFFECT OF AN APPLIED dc-ELECTRIC FIELD
I. N. Bandeira, H. Closs, and C. C. Ghizoni May 1981 22 p refs Submitted for publication
(INPE-2084-RPE/316) Avail: NTIS HC A02/MF A01

The photoacoustic spectroscopy of semiconductors is considered through a phenomenological approach, emphasizing carrier diffusion effects, enhanced by an applied electric field. Experimental results support the proposed model, and lead to the determination of various important semiconductor parameters including recombination rates, surface recombination velocities, and optical absorption coefficients at long wavelengths. M.G.

N81-29012# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
ELECTROMAGNETISM IN INTERACTION WITH DEFORMABLE SOLIDS Final Report, Feb. 1969 - Oct. 1980
H. F. Tiersten May 1981 48 p refs
(Contract N00014-76-C-0368; NR Proj. 318-009)
(AD-A100144; Rept-33) Avail: NTIS HC A03/MF A01 CSCL 20/12

The research effort encompasses three subject areas consisting of the following: (1) Electromagnetism in interaction with conducting and nonconducting polarizable and magnetizable deformable solid continua; (2) The vibrations of piezoelectric plates and rods; and (3) Elastic surface waves guided by thin films.
GRA

N81-29013# Dayton Univ., Ohio. Dept. of Physics.
CHARACTERIZATION OF 3-5 SEMICONDUCTORS Final Report, 1 Jun. 1976 - 30 Nov. 1980
David C. Look, Marshall M. Kreitman, Phil Won Yu, Sang Boo Nam, John W. Farmer, and Dennis C. Walters Wright-Patterson AFB, Ohio AFWAL Apr. 1981 119 p refs
(Contract F33615-76-C-1207; AF Proj. 2306)
(AD-A100399; AFWAL-TR-81-1036) Avail: NTIS HC A06/MF A01 CSCL 20/12

Impurities and defects in semiconducting and semi-insulating GaAs and InP have been investigated by electrical, optical, and mass spectroscopic techniques. Author (GRA)

N81-29014# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
INVESTIGATION OF THE ACTIVATION OF IRON-TITANIUM-CRYSTALS BY MEANS OF METALLOGRAPHY AND HYDROGEN GASSING
S. Pietz Aug. 1979 97 p refs In GERMAN
(JUEL-SPEZ-52) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

The initial loading process of FeTi alloys was studied to investigate their use as hydrogen storage materials. Several FeTi alloys with Mn, C, Al, O additives and LaNi5 were loaded with hydrogen. The loading kinetics were investigated as a function of the temperature, of hydrogen gas pressure, of the grain size distribution and partially also in a mixture with FeTi and La Ni5. DOE

N81-29015# Pennsylvania State Univ., University Park.
PHOSPHORUS SEGREGATION TO GRAIN BOUNDARIES IN A Fe-0.04% P ALLOYS
T. Sakurai, Y. Kuk, H. J. Grabke (Max-Planck-Inst. fuer Eisenforschung, Dusseldorf), A. K. Birchenall, and H. W. Pickering 1980 7 p refs Presented at the 27th Intern. Field Emission Symp.,

Tokyo, 7-11 Jul. 1980
(Contract DE-AC02-89ER-10430)
(CONF-800730-6) Avail: NTIS HC A02/MF A01

Grain boundaries were successfully observed in a Fe.0.04% P alloy usng a field ion microscope (FIM). The composition along a grain boundary was analyzed using a high performance time of flight atom probe. Phosphorus was found to segregate to the grain boundaries below 600 C which 10 agreement with the previous Auger electron spectroscopy studies. DOE

N81-29016# Emory Univ., Atlanta, Ga. Dept. of Physics.
FAR-INFRARED STUDIES OF SUPERCONDUCTING V3Si, Nb3Ge, AND Nb Progress Report
Sidney Perkowitz 23 Feb. 1981 7 p
(Contract DE-AS05-76ER-10436)
(DOE/ER-10436/2) Avail: NTIS HC A02/MF A01

Optical techniques in the far infrared region are to explore the basic superconducting behavior of the high temperature superconductors V3Si, Nb3Ge, Nb, and granular NbN. Such spectroscopy yields accurate gap values, information about the temperature dependence of superconducting properties, values of the electron photon spectral function, and insight into grain to grain coupling in inhomogeneous geometries. These results are used to calculate basic superconducting parameters such as the coupling constant and the transition temperature with the aim of explaining the underlying physics of superconductors. DOE

N81-29017# Los Alamos Scientific Lab., N. Mex.
LASL Nb3Ge CONDUCTOR DEVELOPMENT Quarterly Progress Report, 1 Apr. - 30 Jun. 1980
M. P. Maley, comp. Dec. 1980 11 p refs
(Contract W-7405-eng-36)
(LA-8606-PR; QPR-16) Avail: NTIS HC A02/MF A01

The development of Nb3Ge as a superconductor with potential applications to power transmission lines is reported. Gallium additions produce a small decrease in T sub c but do not appear to enhance H sub c2. A large bending moment generated by differential thermal contraction between the Nb3Ge coat and the copper substrate is responsible for longitudinal edge cracks. Problems in the development of a superconductor from a copper strip coated with a thin layer of niobium germanium (Nb3Ge) polycrystals is described. The conductor was made with several thicknesses of coating, and the thick coatings developed a crack. DOE

N81-29018# Pennsylvania State Univ., University Park.
OBSERVATION OF GRAIN BOUNDARY SEGREGATION ON AN ATOMIC SCALE IN A Fe-0.4% P ALLOY BY ATOM-PROBE FIM
T. Sakurai, Y. Kuk, H. J. Brabke (Max-Planck-Inst. fuer Eisenforschung), A. K. Birchenall, and H. W. Pickering 1980 4 p refs Presented at the Electrochem. Soc. Meeting, Hollywood, Fla., 5-10 Oct. 1980
(Contract DE-AC02-79ER-10430)
(DOE/ER-10430/9; CONF-8010159-3) Avail: NTIS HC A02/MF A01

Grain boundaries introduced intentionally in a Fe-0.04% P alloy by cold-working were successfully observed using a field ion microscope (FIM), and the composition along a grain boundary was analyzed using a high-performance time-of-flight atom-probe. Phosphorus was found to segregate to the grain boundaries below 600 C, in agreement with previous Auger electron spectroscopy studies. In addition to P, it was found that several other elements, such as Ti, O, C and Mn segregate to the grain boundaries at different annealing temperatures. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-29019 Delaware Univ., Newark.
STATISTICAL MECHANICAL PERTURBATION THEORY: A STUDY OF LIQUIDS AND THEIR MIXTURES Ph.D. Thesis
Jose Omar Valderrama 1981 253 p
Avail: Univ. Microfilms Order No. 8113904

A statistical mechanical perturbation theory using a monspherical reference potential for thermodynamic calculations is studied. This theory starts with the thermodynamic properties of a reference system of nonspherical nonpolar molecule and then introduces the effects of electrostatic moments by a perturbation series expansion method. The necessary mathematical techniques and computer methods for the detailed calculations involved in this theory are developed. For pure fluids, where Monte Carlo and molecular dynamics computer simulation data are pair correlation function and the Helmholtz free energy are studied in detail. Approximations are introduced to develop a method for predicting the effect of quadrupolar forces on the Helmholtz free energy and activity coefficients in mixtures of homonuclear diatomic molecules in which at least one of the species contains a permanent quadrupole moment. With those approximations, general equations for the quadrupolar contribution to the activity coefficient in terms of the density and molecular size parameters are obtained. Dissert. Abstr.

N81-29020 South Carolina Univ., Columbia.
ASPECTS OF INTERFERENCE AND MEASUREMENT IN QUANTUM THEORY Ph.D. Thesis
Mordechai Israel Vardi 1980 61 p
Avail: Univ. Microfilms Order No. 8114358

An answer to the question of whether non-realizable Hamiltonians can be relied is used to give an experimental meaning to the Hamiltonian that describes the measurement process. When applying the rules of quantum mechanics to rapidly repeated measurements which tend to check the exact moment in which a system makes a transition from one some initial state to some other final state, it is shown that not only can the system be frozen in its initial state, it can also be forced to evolve along a trajectory of states by successive measurements that are made dense in some given period of time. A phase is systematically accumulated when the system is forced along the trajectory. The principle of superposition is used to show that, in a thought experiment, the phases associated with those trajectories can be made to interfere which means that the action, as a global quantity, can have a measureable meaning. The double Stern-Gerlach experiment is combined with the Aharonov-Bohn effect to show that the nonlocal aspects of quatum mechanics manifest themselves in a deterministic way or a nondeterministic way, depending on the set-up chosen. Dissert. Abstr.

N81-29021# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF CIRCUMFERENTIAL TUBE WALL HEAT CONDUCTION UPON LAMINAR FILMWISE CONDENSATION ON THE OUTSIDE OF CONDENSER TUBES M.S. Thesis
Howard Michael Holland Dec. 1980 56 p refs
(AD-A100118) Avail: NTIS HC A04/MF A01 CSCL 20/13

This thesis describes the results of a theoretical study to predict the thermal behavior of an internally-cooled tube in a condensing vapor. The analysis constitutes a unique application of the finite element method and provides new insights into the effects of circumferential conduction upon condenser tube performance. Comparisons are made between the present analysis and the theoretical and experimental works of others. The inclusion of circumferential conduction leads to an improvement in the predictive capabilities of the analytical model. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-29022*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
RESEARCH IN SPACE PHYSICS AT THE UNIVERSITY OF IOWA Annual Report, 1980
J. A. VanAllen Jul. 1981 56 p Sponsored by NASA
(NASA-CR-164638) Avail: NTIS HC A04/MF A01 CSCL 05B

Currently active projects conducted to extend knowledge of the energetic particles and the electric, magnetic, and electromagnetic fields associated with Earth, other celestial bodies, and the interplanetary medium are summarized. These include investigations and/or instruments for Hawkeye 1; Pioneers 10 and 11; Voyagers 1 and 2; ISEE; IMP 8; Dynamics Explorer; Galileo; Spacelab and Orbital flight test missions; VLBI; and the International Solar Polar mission. Experiments and instruments proposed for the future international comet mission, the origin of plasmas in the Earth's environment mission, and the NASA active magnetospheric particle tracer experiment are mentioned. A.R.H.

N81-29023# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Flight Mechanics Panel.
DESIGN TO COST AND LIFE CYCLE COST
William E. Lamar May 1981 30 p Report previously announced as N81-11902
(AGARD-AR-165; ISBN-92-835-1387-8) Avail: NTIS HC A03/MF A01

Summaries of the papers delivered at the symposium, an account of the closing round table discussion, and an extensive listing of conclusions and recommendations in the area of design to cost and life cycle costing are presented. The sessions covered: (1) life cycle methodology and its relation to relation to specifications and requirements; (2) impact of life cycle costs analyses on total system design; (3) cost control of operations and support; and (4) life cycle cost of subsystems and components. The papers delivered at each session are listed. A.R.H.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-29024 Washington Univ., Seattle.
THE DATABASE SEMANTICS OF TIME Ph.D. Thesis
Tera Lougenia Anderson 1981 322 p
Avail: Univ. Microfilms Order No. 8113428

The Discrete Time Domain Generalization is used to examine and define consistency constraints for time-dependent informaton in a database. For example, by introducing a graphical description of a process at the conceptual level, it is possible to constrain the chronological order of event sequences for the process. Other consistency contraints such as event duration and event mutual exclusion are also presented. Dissert. Abstr.

N81-29025 California Univ., Berkeley.
AN INTEGRATED, INTERACTIVE, USER-ORIENTED BIOMEDICAL DATA ACQUISITION, PROCESSING, AND DISPLAY SYSTEM Ph.D. Thesis
Steven Leslie Horowitz 1980 205 p
Avail: Univ. Microfilms Order No. 8113072

An integrated biomedical data acquisition, processing, and display software system for researchers with limited computing skill is described. A researcher may operate the system without knowing computer languages, file system formats, or peripheral device interfaces. Software methodology underlying the system employs certain input, output, and storage devices, but is independent of any particular operating system or hardware implementation. The system combines and extends existing signal acquisition, interactive computation, and dataset manipulation approaches with features developed specifically for biomedical data processing applications. Innovations include: user-oriented input/output protocols; propagation of narrative and numerical information across system modules; interactive marking of ignificant physiological event times; construction and management of archival and resident experiment datasets; accessibility of differentiated and filtered signals; a subroutine library for custom analysis programming; and interfaces for user-defined virtual and external data. Dissert. Abstr.

N81-29026* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BIBLIOGRAPHY OF LEWIS RESEARCH CENTER TECHNICAL PUBLICATIONS ANNOUNCED IN 1980
May 1981 373 p
(NASA-TM-82661; E-9449-5) Avail: NTIS HC A16/MF A01 CSCL 05B

This compilation of abstracts describes and indexes over 780 research reports, journal articles, conference presentations, patents and patent applications, and theses resulting from the scientific and engineering work performed and managed by the Lewis Research Center in 1980. All the publications were announced in Scientific and Technical Aerospace Reports and/or International Aerospace Abstracts. A.R.H.

N81-29027*# California Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY 1980
15 Jul. 1981 32 p
(NASA-CR-164636; JPL-Bibl-39-22) Avail: NTIS HC A03/MF A01 CSCL 05B

The Bibliography cites 385 externaly distributed technical reports, released during calendar year 1980, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. Three classes of publications are included: (1) JPL Publications (77-, 78-, 79-series, etc.); (2) articles published in the open literature; and (3) articles from the biomonthly Deep Space Network (DSN) Progress Report (42 series) and its successor, the Telecommunications and Data acquisition (TDA) Progress Report (also 42-series). The citations are listed alphabetically by primary author. A.R.H.

N81-29028# Avco-Everett Research Lab., Mass.
TECHNICAL SUPPORT FOR THE SCIENTIFIC INFORMATION EXCHANGE PROGRAM BETWEEN POLISH PEOPLES REPUBLIC AND US DEPARTMENT OF ENERGY Final Report
1980 16 p refs
(Contracts DE-AC01-78ET-12346; ET-78-C-01-3437)
(DOE/ET-12346/T1) Avail: NTIS HC A02/MF A01

The effects of certain operating parameters on the plasma generated by the 4 to 5 MW coal combustor in Swierk, Poland was determined. The operating operating parameters include: (1) coal type, (2) coal moisture content, (3) seed injection, (4) slag removal, (5) coal size distribution, (6) equivalence ratio and (7) NO sub x, CO and SO sub x content in the exhaust gas. DOE

N81-29029# National Science Foundation, Washington, D. C. Directorate for Engineering and Applied Science.
RECENT RESEARCH REPORTS: ENTRIES 1175-1317
Dec. 1980 125 p
(Grant NSF ISF-75-22472)
(PB81-174575; NSF/RA-800323) Avail: NTIS HC A06/MF A01 CSCL 05/3

Abstracts of documents resulting from research programs supported by the Directorate for Engineering and Applied Science (EAS) of the National Science foundation. These citations describe current research in the following areas: electrical, computer, and systems engineering, chemical and process engineering, civil and mechanical engineering, applications in social and behavioral sciences, physics, mathematics, biological science, and engineering problem focused research in alternative biological sources of materials and earthquake hazards mitigation and intergovernmen-

tal science and public technology at local state and Federal levels. University-industry programs technology innovated projects experimental programs, technology innovated projects, experimental programs, and research reports from previously supported research applications programs are also described. J.D.H.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-29030*# Textron Bell Helicopter, Fort Worth, Tex.
ASSESSMENT OF HISTORICAL AND PROJECTED SEGMENTS OF US AND WORLD CIVIL AND MILITARY ROTORCRAFT MARKETS, 1960 - 1990
William J. Yates Jan. 1981 204 p refs
(Contract NAS2-10404)
(NASA-CR-166151) Avail: NTIS HC A10/MF A01 CSCL 05C

The geographic climatic, political, economic and demographic environment of 75 countries was analyzed with respect to helicopter procurement history and usage. Key environmental indicators which are variables were projected into strengths and weaknesses of U.S. technology are reviewed. The civil market sensitivity to new technology is forecast with selected premises as to vehicle life, noise standards, fuel costs, GNP expansion and traffic growth. The forecast is based on a scenario of helicopter technology improvements resulting in increased size and performance. A.R.H.

N81-29031# Texas Univ. at Arlington. Center for Energy Studies.
AN ANALYSIS OF FINANCIAL AND REGULATORY MODELS OF ELECTRIC UTILITIES
Alicia Torre Apr. 1981 62 p refs
(RR-12) Avail: NTIS HC A04/MF A01

Five financial and regulatory models were analyzed in terms of their use in a larger modelling project to measure conservation impact on utilities (CIUS). The five models are the Over/Under Capacity Planning Model (Over/Under), the Regulatory Analysis Model (RAM), the Electric Utility Policy and Planning Analysis Model (EPPAM), the Regionalized Electricity Model (REM), and the electric and Gas Utility Financial Simulation Model (ELFIN). No matter which model is used, certain modifications are necessary for use with CIUS. T.M.

N81-29032# Texas Univ. at Arlington. Center for Energy Studies.
A PRELIMINARY ANALYSIS OF THE NATURAL GAS MARKET-ORDERING PROBLEM
Robert C. Means Feb. 1981 133 p refs
(Policy-Study-15) Avail: NTIS HC A07/MF A01

Application of microeconomic analysis to the provisions of the Natural Gas Policy Act predict that partial deregulation of natural gas in 1985 will result in price discontinuity, misdirected benefits, and market raiding. The principal factual issues that must be resolved in any full assessment of this market ordering problem are considered. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-29033# Committee on Science and Technology (U. S. House).
THE 1982 NASA AUTHORIZATION, VOLUME 3
Washington GPO 1981 327 p Hearings before the Subcomm. on Transportation, Aviation and Mater. of the Comm. on Sci. and Technol., 97th Congr., 1st Sess., no. 4, 10-11, 26 Feb. and 19 Mar. 1981
(GPO-78-168-Vol-3) Avail: Subcommmittee on Transportation, Aviation and Materials

Budget requests to support NASA's aeronautics program are justified. Areas convered include research in aerodynamics; propulsion; materials and structures; guidance and control; and human factors. Particular attention is given to avionics and alternative fuel technology for all vehicle classes. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N81-29034*# National Academy of Sciences - National Research Council, Washington, D. C.
NASA'S AERONAUTICS PROGRAM: SYSTEMS TECHNOLOGY AND EXPERIMENTAL PROGRAM Final Report
1980 40 p
(Contract NASw-2342)
(NASA-CR-164642) Avail: NTIS HC A03/MF A01 CSCL 05A

The appropriateness of the division of effort between the directed to the solution of near-term problems and that directed to long-term technical advances in the program is addressed. Comparisons between in-house work and out-of-house work are presented. Programs include those in: general aviation; propulsive lift; rotorcraft; avionics and flight controls; small transport aircraft; and human/vehicle systems. T.M.

N81-29035*# Cleveland State Univ., Ohio. Dept. of Electrical Engineering.
MINIMUM FUEL CONTROL OF A VEHICLE WITH A CONTINUOUSLY VARIABLE TRANSMISSION Final Technical Report, 1 Oct. 1978 - 30 Jun. 1980
James H. Burghart and John F. Donoghue 30 Jun. 1980 94 p refs
(Grant NsG-3223)
(NASA-CR-164587) Avail: NTIS HC A05/MF A01 CSCL 13F

The design and evaluation of a control system for a sedan with a heat engine and a continuously variable transmission, is considered in a effort to minimize fuel consumption and achieve satisfactory dynamic response of vehicle variables as the vehicle is driven over a standard driving cycle. Even though the vehicle system was highly nonlinear, attention was restricted to linear control algorithms which could be easily understood and implemented demonstrated by simulation. Simulation results also revealed that the vehicle could exhibit unexpected dynamic behavior which must be taken into account in any control system design. A.R.H.

N81-29036*# Franklin Inst. Research Labs., Philadelphia, Pa.
ADVANCED dc MOTOR CONTROLLER FOR BATTERY-POWERED ELECTRIC VEHICLES
Charles A. Belsterling Jul. 1981 98 p refs
(Contracts DEN3-46; DE-AI01-77CS-51044)
(NASA-CR-165171; DOE/NASA/0046-81/1) Avail: NTIS HC A05/MF A01 CSCL 13F

A motor generation set is connected to run from the dc source and generate a voltage in the traction motor armature circuit that normally opposes the source voltage. The functional feasibility of the concept is demonstrated with tests on a Proof of Principle System. An analog computer simulation is developed, validated with the results of the tests, applied to predict the performance of a full scale Functional Model dc Controller. The results indicate high efficiencies over wide operating ranges and exceptional recovery of regenerated energy. The new machine integrates both motor and generator on a single two bearing shaft. The control strategy produces a controlled bidirectional plus or minus 48 volts dc output from the generator permitting full control of a 96 volt dc traction motor from a 48 volt battery, was designed to control a 20 hp traction motor. The controller

weighs 63.5 kg (140 lb.) and has a peak efficiency of 90% in random driving modes and 96% during the SAE J 227a/D driving cycle. A.R.H.

N81-29037*# Chilton Co., Radnor, Pa. Catalog Div.
CATALOG OF COMPONENTS FOR ELECTRIC AND HYBRID VEHICLE PROPULSION SYSTEMS Final Report
H. C. Eissler Jan. 1981 930 p
(Contracts DEN3-194; DE-AC01-77CS-51044)
(NASA-CR-165257; DOE/NASA/0194-1) Avail: NTIS HC A99/MF A01 CSCL 13F

This catalog of commercially available electric and hybrid vehicle propulsion system components is intended for designers and builders of these vehicles and contains 50 categories of components. These categories include those components used between the battery terminals and the output axle hub, as well as some auxiliary equipment. An index of the components and a listing of the suppliers and their addresses and phone numbers are included. Author

N81-29038# Committee on Science and Technology (U. S. House).
APPLICATION OF TECHNOLOGY TO HANDICAPPED INDIVIDUALS: PROCESS, PROBLEMS AND PROGRESS
Washington GPO 1980 328 p refs Rept. presented to the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol. and the Subcomm. on the Handicapped of the Comm. on Labor and Human Resources, 96th Congr., 2nd Sess., Apr. 1980 Prepared by the Congressional Research Service, Library of Congress
(GPO-60-319) Avail: SOD HC

The diversity of existing, emerging, and conceptual developments aimed at helping persons with disabilities are explored and relevant issues relating to proper application of technological developments in this area are examined in transcripts from three workshops held to assist members of Congress and their staffs in understanding how various technologies render persons with handicaps more independent in achieving personal and vocational goals. Legislative initiatives are reviewed and the need for cooperative effort to reduce costs is considered. A.R.H.

N81-29039# California Univ., Livermore. Lawrence Livermore Lab.
ESTIMATES OF THE COST AND ENERGY CONSUMPTION OF ALUMINUM-AIR ELECTRIC VEHICLES
J. F. Cooper Nov. 1980 85 p refs Presented at the Fall Meeting of the Electrochem. Soc., Hollywood, Fla., 5 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-84445; CONF-8010159-1) Avail: NTIS HC A05/MF A01

Economic costs and primary energy consumption are estimated for general purpose electric vehicles using aluminum-air propulsion batteries within the time frame of the 1990's (earliest possible date of introduction). The results show that for a 40 kW, 70 kWh battery used in a vehicle traveling 16,000 km/y, the total capital investment in electricity and aluminum production plants and fuels distribution system was 2250 dollars or 32 dollar sq/kWh. Of this, the aluminum plants contributed 60 percent, and the fuels disribution system, 3 percent (less than 1 dollar/kWh). The introduction of 1,000,000 vehicles per year in 1995 would increase domestic aluminum demand by below 5 percent per year, and electricity demand by less than 0.2 percent per year. DOE

N81-29040# California Univ., Livermore. Lawrence Livermore Lab.
ADVANCED VEHICLE OF THE DOE ELECTRIC AND HYBRID VEHICLE PROGRAM
Lawrence G. OConnell Dec. 1980 37 p refs Presented at the Elec. and Hybrid Vehicle Advan. Technol. Seminar, Pasadena, Calif., 8 Dec. 1980
(Contract W-7405-eng-48)
(UCRL-85390; CONF-801232-5) Avail: NTIS HC A03/MF A01

The performance requirements for and the technical or economic barriers which must be overcome in the development and production of advanced electric vehicles (EV) or hybrid-electric vehicles are discussed. The technologies compared include EV's using battery exchange, hybrid EV's using batteries and a small heat engine, roadway powered EV's, EV's with aluminum air batteries, and EV's with fuel cells. DOE

N81-29041# California Univ., Livermore. Lawrence Livermore Lab.
ROADWAY POWERED ELECTRIC VEHICLE (RPEV) SYSTEM CONCEPT DESCRIPTION AND PROJECT OVERVIEW
D. D. Davis and Carl E. Walter Dec. 1980 15 p refs Presented at Elec. and Hybrid Vehicle Advan. Technol. Seminar, Pasadena, Calif., 8 Dec. 1980
(Contract W-7405-eng-48)
(UCRL-85425; CONF-80142-4) Avail: NTIS HC A02/MF A01

A program for evaluating the practicality of roadway powered electric vehicles, and the design and construction of laboratory and roadway facilities for testing these vehicles are discussed. DOE

N81-29042# Argonne National Lab., Ill. Energy and Environment Systems Div.
APPLICATION OF A METHODOLOGY FOR EVALUATION OF INTERTECHNOLOGY TRADEOFFS: AN ILLUSTRATIVE CASE STUDY
R. G. Whitfield, W. A. Buehring, M. J. Jusko, and T. D. Wolsko Nov. 1980 49 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-127) Avail: NTIS HC A03/MF A01

The problem of selecting the best research and development for developing long term energy technologies that use coal is discussed. Best is defined in terms of 11 attributes, or measures of performance. Uncertainties were determined for the many, complex outcomes that result from each strategy, and the information was systematically structured for evaluation. Preferences for the various outcomes were quantified by assessing a multi-attribute utility function over the 11 single attributes. The best alternative was chosen using maximization of expected utility as a guide. Extensive sensitivity analyses showed that one strategy, evolutionary development, was best over a wide range of plausible assumptions. DOE

N81-29043# Bendix Field Engineering Corp., Grand Junction, Colo.
IMPORTANCE OF RESOLUTION FOR HELIUM DETECTORS USED IN URANIUM EXPLORATION
A. Zaikowski and E. H. Roberts Feb. 1981 19 p refs
(GJBX-38(81)) Avail: NTIS HC A02/MF A01

A small mass spectrometer of the 4He detector type used in uranium exploration was modified to enable magnetic scanning of its mass spectrum. Spectra obtained from the instrument allow determination of interferences from adjacent mass peaks. Hydrogen outgassed from the system or produced by molecular dissociation can be a principal extraneous species. If not thoroughly removed from a system, it can contribute to the ion current of the 4He mass peak. Correlations of 4He with soil gas moisture found in prior studies may not be due to true variation in 4He but may be ascribable to artifacts resulting from H2 contributions to 4He. Such artifacts can be corrected for by converting field instruments to a scanning mode. DOE

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-29044 California Univ., Berkeley.
OPTICAL STUDIES OF FAINT BLUE X-RAY STARS

Ph.D. Thesis
John Robert Thorstensen 1980 118 p
Avail: Univ. Microfilms Order No. 8113211

Positive identifications for 4U 1254-69, 4U 1822-37, Ser X-1, AqlX-1, and 4U 2129+47, and a candidate identification for 4U 0042+32 are reported. AqlX-1 suffers intense flares roughly once per year, but is otherwise quiescent. During quiesence the optical spectrum is that of a K star. This strongly supports a binary model. The system 4U 2129+47 shows a 1.5 magnitude photometric modulation with a 5.24 hour period. The light curve is approximately sinusoidal: this together with other evidence shows that the majority of the light comes from the X-ray heated face of a late-type dwarf. Computations of the mass, the distance, and the X-ray luminosity suggest that the compact object is a degenerate dwarf. The results of the study of the photometric variability of a sample of X-ray dominated sources are presented. These stars are typically only slightly variable. Combining this result with a geometrical model for these systems, it is argued that the major portion of the optical light cannot typically originate at the X-ray heated face of the normal star. Dissert. Abstr.

N81-29045 Washington Univ., Seattle.
PULSE TIMING TECHNIQUES AND APPLICATIONS TO X-RAY PULSARS Ph.D. Thesis
John Emerson Deeter 1981 206 p
Avail: Univ. Microfilms Order No. 8113437

The application of pulse timing analysis techniques to X-ray pulsars, chiefly the determination of binary orbit elements and the use of timing noise as a probe of neutron star structure, is studied. The methods of elementary pulse timing are applied to satellite observations of the binary X-ray pulsar Her X-1. The circularity of the orbit is confirmed, with eccentricity less than 0.0003, and the orbital period is constant over the span of the data. Power spectra for Her X-1 and the Crab pulsar (a radio pulsar--the same goals and methods apply) are computed. Both systems exhibit white torque noise over the range of accessible frequencies. Dissert. Abstr.

N81-29046# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BRAZIL NATIONAL REPORT ON RADIO ASTRONOMY (1978-1980) Internal Report, 1978 - Apr. 1981
P. Kaufmann May 1981 5 p refs Presented at the 20th Gen. Assembly, Washington, D.C., 10-19 Aug. 1981
(INPE-2065-RPE/307) Avail: NTIS HC A02/MF A01

Topics covered in the period 1978 - April 1981 include: radiometric atmospheric transmission determinations; very long base interferometry experiments using a Mk.I terminal; radio physics of the Sun; radio recombination line; atmospheric surveys. S.F.

N81-29047*# Carson Alexiou Corp., Costa Mesa, Calif.
NASA AMES INFRARED DETECTOR ASSEMBLIES Final Report
15 Oct. 1979 23 p
(Contract NAS2-10136)
(NASA-CR-166215) Avail: NTIS HC A02/MF A01 CSCL 03A

Silicon: Gallium infrared detector assemblies were designed, fabricated, and tested using techniques representative of those employed for hybrid arrays to determine the suitability of this candidate technology for infrared astronomical detector array applications. Both the single channel assembly and the assembly using a 32 channel CMOS multiplexer are considered. The detector material was certified to have a boron background of less than 10 to the 13th power atoms/sq cm counter doped with phosphorus. The gallium concentration is 2 x 10 to the 16th power atoms/cu cm. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-29048 Wisconsin Univ. - Madison.
X-RAY OBSERVATIONS AND RECOMBINATION STELLAR WIND THEORY FOR THE CORONAE OF OB SUPERGIANTS Ph.D. Thesis
Wayne Lee Waldron 1980 152 p
Avail: Univ. Microfilms Order No. 8110107

The coronal structure of OB supergiants is investigated both observationally and theoretically. Results of a survey of / emission from luminous early-type stars made using the imaging proportional counter on the Einstein Observatory indicate that all Of stars and early OB supergiants and at least a fraction of later B supergiants are X-ray sources. Spectral analysis of the X-ray from 9 Sgr, zeta Pup, epsilon Ori and Kappa Ori show that the energy distributions are consistent with an exterior or extended coronal zone model rather than a thin slab coronal zone at the base of the wind. A study of the transition from coronal conditions to radiatively driven winds in OB supergiants shows that in the 'recombination zone', the wind may be optically thick in resonance lines which allows an extended high temperature zone before rapid cooling occurs. Models are presented for three luminous O and B stars. Dissert. Abstr.

N81-29049 Wisconsin Univ. - Madison.
SPICULAR DOWNFLOWS IN LATE-TYPE GIANT CORONAE Ph.D. Thesis
Steven Gerard Wallenhorst 1980 83 p
Avail: Univ. Microfilms Order No. 8107052

Models of the coronae of late type stars are considered under the assumption that the dominant coronal energy loss is not conduction as is usually assumed, but rather the losses due to hot spicular material falling back onto the chromosphere. This assumption is used to estimate the increase in stellar mass loss rate which should occur when stars evolve across the so called supersonic transition locus. For a constant downward number flux this increased is estimated to be about one order of magnitude. Energy balance models are then considered for spicule dominated coronae under the additional assumption that the energy input flux to the corona is constant over a star's post main sequence evolution; this assumption is found to be consistent with observed red giant mass-loss rates. A sequence of models is constructed which enables the various coronal parameters to be estimated for different masses and radii. Solutions which precisely satisfy the constant flux assumption are not found to exist for solar mass stars; this may be due to the constant flux assumption's not being rigorously true, or may result from an incorrect assumption about the coronal base pressures or the magnitude of the input flux. Dissert. Abstr.

N81-29050 California Univ., Berkeley.
DYNAMICAL PROCESSES IN SMALL STELLAR SYSTEMS Ph.D. Thesis
John Michael Retterer 1980 226 p
Avail: Univ. Microfilms Order No. 8113170

A simple dynamical model for the evolution of star clusters of all sizes is presented. Close two-body encounters are studied. The effect of encounters on the internal energies of binaries is considered and the evolution of the internal-energy distribution of the binaries is calculated under a variety of circumstances. The way in which superelastic encounters with the binaries affect the velocity distribution of the stars in the cluster and thus influences the cluster's evolution is discussed. Simple dynamical models are used to describe the evolution of star clusters. These models are constructed by using an evaporative treatment of two-body relaxation, along with the influence of binaries, to evolve the cluster structure along a series of equilibrium King cluster models, including the effects of equipartition and of velocity anisotropy. These models are successful in reproducing the behavior of clusters found in other, more detailed studies of cluster evolution. Dissert. Abstr.

N81-29051 California Univ., Berkeley.
ZEEMAN EFFECT MEASUREMENTS OF INTERSTELLAR NEUTRAL HYDROGEN Ph.D. Thesis
Thomas Hugh Troland 1980 73 p
Avail: Univ. Microfilms Order No. 8113216

A search for the Zeeman effect in the 21 cm line of Galactic neutral hydrogen (HI) is reported. This program was undertaken with the 26 m radio telescope at Hat Creek Observatory. We

have carefully investigated the causes and remedies for instrumental circular polarization in the 26 m telescope. These effects can, in principle, impose the most severe limitation upon high-sensitivity HI emission line Zeeman effect measurements. Some components of instrumental circular polarization can be reduced to negligible proportions; the remaining components do not have a serious effect upon the Zeeman effect data at our current levels of sensitivity. The magnetic field is unexpectedly small in many HI emission and absorption regions. Since the field strengths we derive for HI regions are so low, magnetic effects in these regions are not likely to appreciably influence motions of the gas. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-29052 Washington Univ., Seattle.
SOME EFFECTS OF GLOBAL DUST STORMS ON THE ATMOSPHERIC CIRCULATION OF MARS Ph.D. Thesis
Robert Michael Haberle 1981 192 p
Avail: Univ. Microfilms Order No. 8113444

The response of the Martian atmosphere to various dust loads and the ability of its meridional circulation to transport dust globally are simulated by using a numerical model based on a two dimensional version of the primitive equations in spherical-sigma coordinates. The circulation is driven by the daily averaged heating rate which consists of contributions from the absorption of solar and infrared radiation by carbon dioxide and dust as well as from sensible heat exchange with the ground. Multiple scattering by dust particles is accounted for by using the Delta-Eddington approximation with optical properties derived from both Viking and Mariner 9 missions. Vertical momentum exchange is based on linear diffusion theory and is formulated in terms of a damping time rather than an eddy viscosity. The model distribution of winds and temperature is compared with zonally averaged values produced by a general circulation model. The results compare favorably, enhancing the credibility of 2-D modeling for Mars. Dissert. Abstr.

N81-29053* National Aeronautics and Space Administration, Washington, D. C.
VENUS GENERAL ATMOSPHERE CIRCULATION DESCRIBED BY PIONEER
28 Jul. 1981 7 p
(NASA-News-Release-81-103; P81-10104) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The predominant weather pattern for Venus is described. Wind directions and wind velocities are given. Possible driving forces of the winds are presented and include solar heating, planetary rotation, and the greenhouse effect. T.M.

N81-29054*# California Inst. of Tech., Pasadena. Geological and Planetary Sciences Div.
EVOLUTION OF THE ATMOSPHERE OF VENUS Final Technical Report, 1 Jan. 1980 - 30 Jun. 1981
Yuk L. Yung 30 Jun. 1981 89 p refs
(Contract NCC2-61)
(NASA-CR-164641) Avail: NTIS HC A05/MF A01 CSCL 03B

The photochemistry of the stratosphere of Venus was modeled using an updated and expanded chemical scheme, and the results of recent laboratory studies. The model satisfactorily accounts for the observations of CO, O2, (1) and SO2 in the stratosphere. Oxygen, derived from CO2 photolysis, is primarily consumed by CO2 recombination and oxidation of SO2 to H2SO4. Photolysis of HCl in the upper stratosphere provides a major source of odd hydrogen radicals essential for the catalytic oxidation of CO. Oxidation of SO2 by O occurs in the lower stratosphere, with the O-O bond broken by S + O2 and SO + HO2. The sensitivity of stratospheric chemistry to ambient H2 abundance was studied and the model prefers the high value (1 10 ppm) recently inferred from the Pioneer Venus ionospheric measurements. The importance of the photochemical production of S2O, (SO)2, S2, H2S2O2 and H2S2O3 is speculated. A number of previously unsuspected similarities between the chemistry of the stratospheres of Venus and the Earth, presented and discussed. A.R.H.

N81-29055# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Planetary and Lunar Exploration.
STRATEGY FOR THE EXPLORATION OF PRIMITIVE SOLAR-SYSTEM BODIES. ASTEROIDS, COMETS AND METEOROIDS 1980-1990
1980 96 p
Avail: NTIS HC A05/MF A01

The relative significance of asteroids, comets, and meteoroids are assessed for understanding the solar system and its relation to the broader cosmos. A long term strategy is proposed for the explorations of asteroids and comets for approximately the decade of the 1980's. Important programmatic elements that support and implement the strategy are examined as well as the experimental capabilities available to carry out measurements needed to fulfill the scientific objectives. The role played by the study of the meteoroids (meteorites, meteors, and interplanetary dust) in an overall program of primitive body investigations is considered. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-29056 Rochester Univ., N. Y.
SOLAR MAGNETO-ATMOSPHERIC WAVES WITH A VERTICAL MAGNETIC FIELD Ph.D. Thesis
Mark Alan Scheuer 1980 164 p
Avail: Univ. Microfilms Order No. 8114138

Magneto-atmospheric waves, which involve the combined restoring forces due to buoyancy, compressibility, and magnetic field, are studied in several model atmospheres permeated by a uniform vertical magnetic field. The results are applied to understand oscillations observed in the umbra of sunspots and to evaluate the possibility of the cooling of sunspots by these waves. The umbral atmosphere is idealized as a three layer model with the chromosphere and corona taken as separation isothermal layers and the convection zone taken as a superadiabatic layer with a linear temperature profile. Magneto-atmospheric waves are studied in model atmospheres consisting of different combinations of these three layers. In the simple isothermal atmosphere, two types of problems are considered: an eigenvalue problem with perfectly conducting, rigid boundaries and a forcing problem in which a harmonic forcing is applied at the base of the atmosphere and outward going waves are considered. Dissert. Abstr.

N81-29057 Princeton Univ., N. J.
GLOBAL SCALE PHOTOSPHERIC VELOCITY FIELDS: PROBES OF THE SOLAR INTERIOR Ph.D. Thesis
Jeffrey Richard Kuhn 1981 166 p
Avail: Univ. Microfilms Order No. 8111279

An attempt to measure the long term behavior of global scale fields is described with an eye toward understanding the conditions below the solar surface that largely determine the photospheric velocity patterns. A 4-sigma detection of convective eddies rotating at the photospheric rate with transverse spatial scales of order 100,000 km, a 3m/s bound to the amplitude of long period global photospheric velocity oscillations, and a method for Fourier analyzing unevenly sampled data are discussed. Dissert. Abstr.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-29058 California Univ., Berkeley.
SOFT X-RAY SPECTRAL AND TEMPORAL PROPERTIES OF GALACTIC SOURCES Ph.D. Thesis
Steven Michael Kahn 1980 236 p
Avail: Univ. Microfilms Order No. 8113088

Calibration data obtained for the flight spare HEAO 1 detector are presented and analyzed. The HEAO 1 soft X-ray spectrum of AM Her is discussed as an example. A technique for directly deconvolving soft X-ray spectra without involving explicit astrophysical assumptions is introduced which is based on the expansion of the incident spectrum in terms of a set of orthonormal singular functions which propagate independently through the detector martix. This deconvolution procedure is then applied to HEAO 1 dats for several X-ray emitting supernova remnants. Time resolved soft X-ray observations of Scorpius X-1 are presented and the short term time variability of Cygnus X-1 as interpreted in terms of generalized shot noise is considered. Dissert. Abstr.

N81-29059 Colorado Univ. at Boulder.
SPECTRAL FORMATION IN X-RAY ILLUMINATED GAS CLOUDS Ph.D. Thesis
Timothy Raymond Kallman 1980 230 p
Avail: Univ. Microfilms Order No. 8113975

The formation of optical and UV emission lines are studied via the Bowen resonance fluorescence mechanism. The results of this study are incorporated into the second investigation, which describes the heating and ionization of spherical gas clouds surroundng compact X-ray sources, together with the radiation field escaping from the clouds. The effects of Compton scattering on an X-ray spectrum, in the limit that the electron temperature is small, are studied. An analytical theory is presented for the change in the X-ray spectrum after a given number of scatterings. This theory is used to determine the spectrum aa s function of time for X-rays scattering in an infinite homogenous medium and for X-rays escaping from spherical clouds. The effects of relativistic corrections and non-zero electron temperature are also discussed. Dissert. Abstr.

N81-29060*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 805S X-RAY PULSAR H2252-035
N. E. White and F. E. Marshall Jun. 1981 16 p refs Submitted for publication
(NASA-TM-82149) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray flux from the 3.6 hr binary system H2252-035 is shown to be modulated at a period of 805s. The spectrum is consistent with either a 1.4 photon index power law or > 20 keV thermal model. A 560t0r-350 eV equivalent width iron line is seen at approximately 6.7 keV. The possibility that this system contains a slowly rotating neutron star is discussed. A.R.H.

N81-29061*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY ANTIPROTONS IN CLOSED GALAXY MODEL
R. Protheroe Jun. 1981 24 p refs Submitted for publication
(NASA-TM-82155) Avail: NTIS HC A02/MF A01 CSCL 03B

The flux of secondary antiprotons expected for the leaky-box model was calculated as well as that for the closed galaxy model of Peters and Westergard (1977). The antiproton/proton ratio observed at several GeV is a factor of 4 higher than the prediction for the leaky-box model but is consistent with that predicted for the closed galaxy model. New low energy data is not consistent with either model. The possibility of a primary antiproton component is discussed. A.R.H.

N81-29062# Central Research Inst. for Physics, Budapest (Hungary).
RESULTS OF COSMIC RADIATION DOSE FIELD MEASUREMENTS ABOARD THE SALYUT-6 ORBITAL STATION
Yu. A. Akatov, T. V. Batenchuk, A. M. Borodin, V. E. Dudkin, A. M. Marenny, V. A. Sakovich, G. G. Vasilev, A. G. Karadjov, P. O. Szabo, and I. Feher Jun. 1980 7 p Presented at the 23rd Topical Meeting of COSPAR, Budapest ISC F b/ Cosmos-Salyut Results and Related Space Flight Factors, Budapest, 2-14 Jun. 1980
(KFKI-1980-35; ISSN-0368-5330; ISBN-063-371-665-9) Avail: NTIS (US Sales Only)HC A02/MF A01; DOE Depository Libraries

During the 3rd main expedition aboard the Salyut-6 orbital station in 1979, the integral characteristics of cosmic radiation were measured in various positions inside the manned modules. Thermoluminescent dosimeters, photographic films and solid state plastic detectors were used. The gradient inside the manned modules of the station amounted to 70 percent for long intervals of time. During the experimental periods, the dose rate inside the station was 15 to 30 mrad per day. The mean flux of particles with z > = 6 and Let > 200 keV/(SIGMA)m was found to be 0.22 cm(+2) day(+1). DOE

99 GENERAL

N81-29063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROSPACE IN THE FUTURE
John F. McCarthy, Jr. May 1980 34 p Presented at CECON, Cleveland, 20-21 May 1980
(NASA-TM-82664; E-575) Avail: NTIS HC A03/MF A01 CSCL 05A

National research and technology trends are introduced in the environment of accelerating change. NASA and the federal budget are discussed. The U.S. energy dependence on foreign oil, the increasing oil costs, and the U.S. petroleum use by class are presented. The $10 billion aerospace industry positive contribution to the U.S. balance of trade of 1979 is given as an indicator of the positive contribution of NASA in research to industry. The research work of the NASA Lewis Research Center in the areas of space, aeronautics, and energy is discussed as a team effort of government, the areas of space, aeronautics, and energy is discussed as a team effort of government, industry, universities, and business to maintain U.S. world leadership in advanced technology. A.R.H.

N81-29064# National Bureau of Standards, Washington, D.C.
NBS DIMENSIONS, VOLUME 64, NO. 10 Monthly Report Dec. 1980 37 p
(PB81-170276; NBS-DIM-64-10) Avail: NTIS HC A03/MF A01 CSCL 14B

Summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications are presented. Contents for this issue are: An Effective National Program, M. Baum; Southern Exposure (passive solar technology), G. Metz; Arson Sniffers (portable vapor detectors), E. Rudin; Neutron Radiography Used forInspecting Jet Engines, G. Porter; Tracealloy Standard Issued, SRM; Activities in Wood-Heating Safety, R. Peacock, and Fluidic Temperature Sensors, T. Negas. GRA

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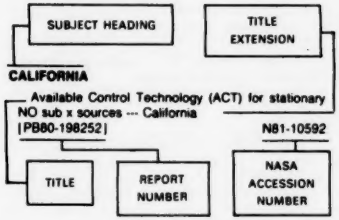

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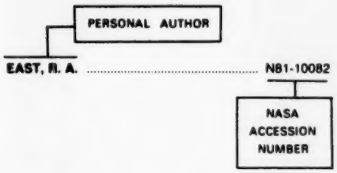

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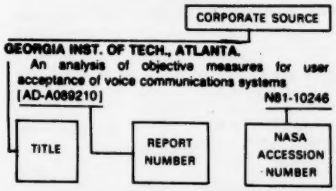

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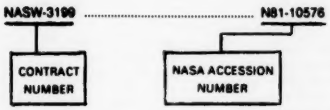

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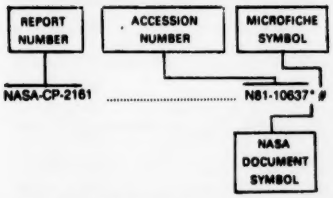

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